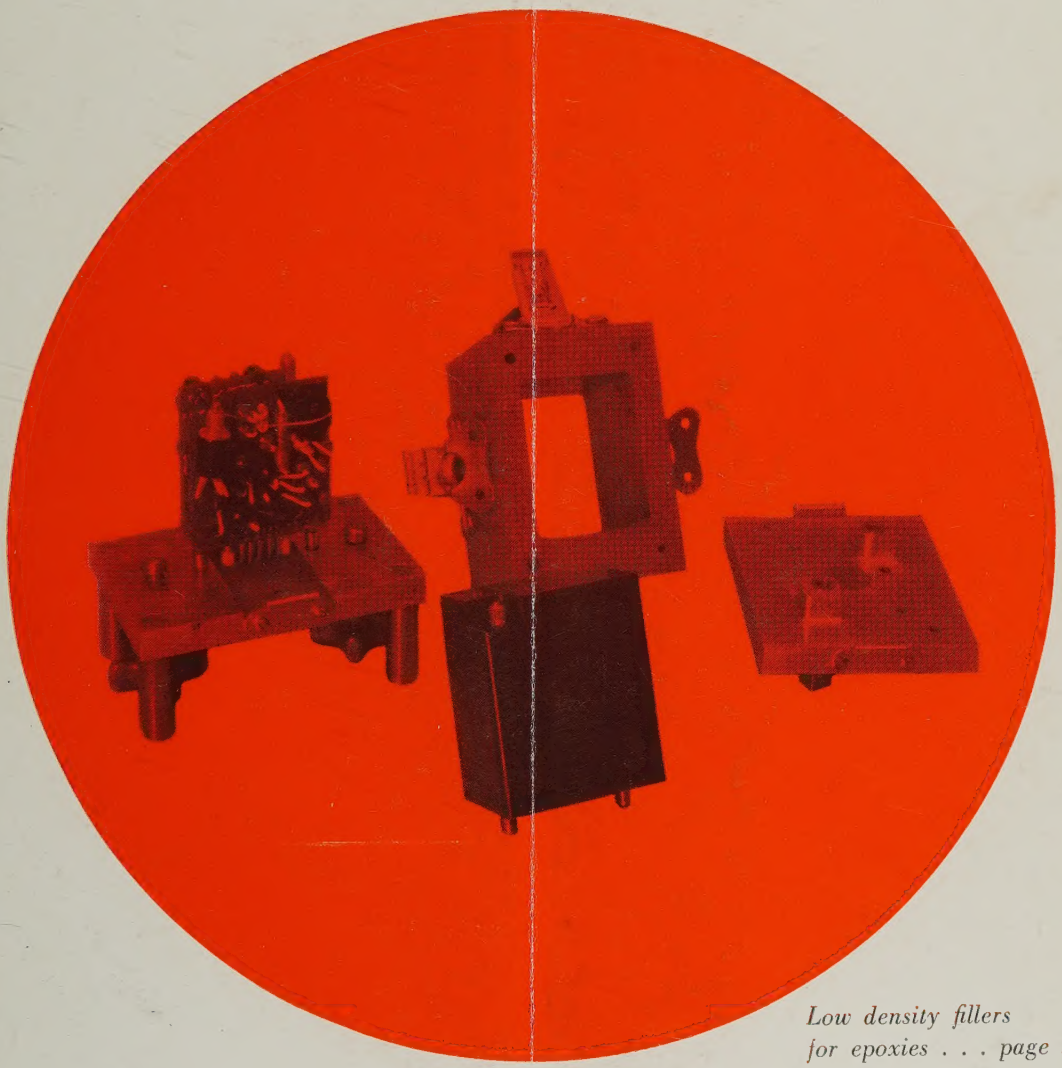
June 1960

Insulation



Low density fillers for epoxies . . . page 21

In this issue:

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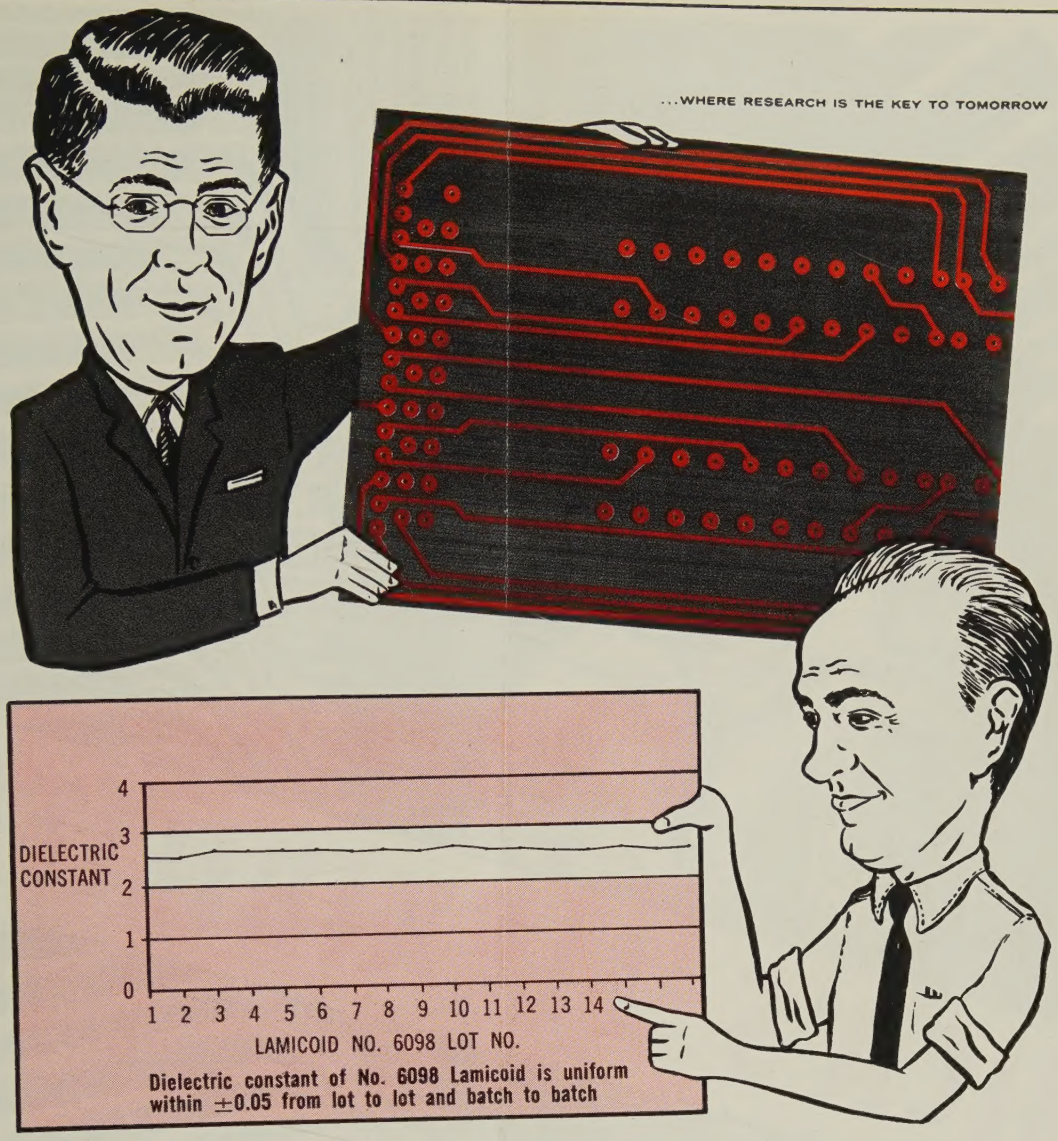

for low losses and high reliability in Microwave and UHF assemblies

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combines these properties

- READILY MACHINED TO CLOSE TOLERANCES
- EASILY SOLDERED
- UNIFORM DIELECTRIC CONSTANT (2.6 ± 0.05)
- SHOCK RESISTANT
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- EXTREME CHEMICAL AND ABRASION RESISTANCE
- HIGH HEAT RESISTANCE (250 C continuous)

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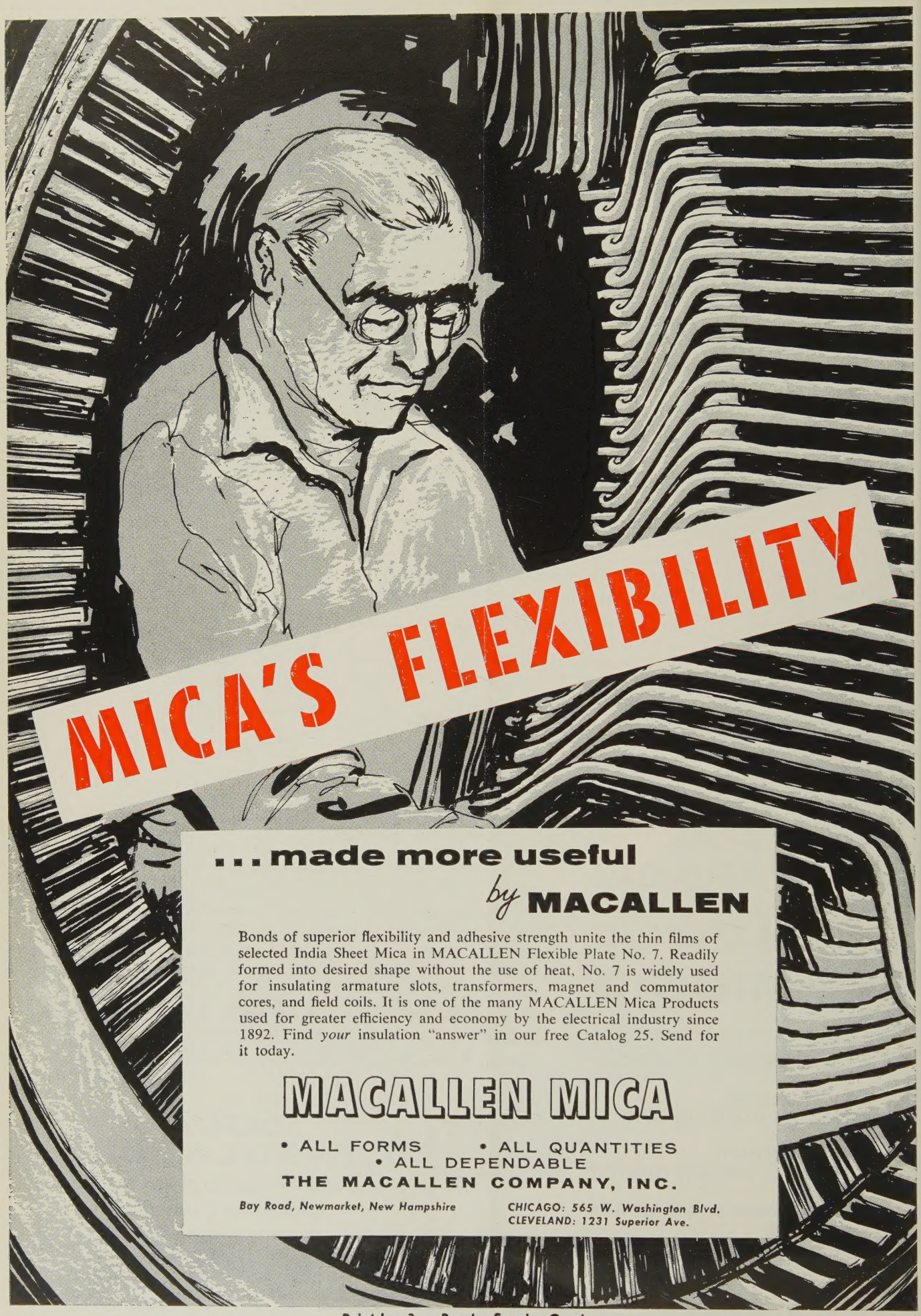

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Insulation

For the Electrical and Electronic Industries

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Assistant Editor and Production Manager: F. P. Mignin
Contributing Editors: Graham Lee Moses, H. K. Graves, Mike Rivise
Art Director: Randall R. Roth
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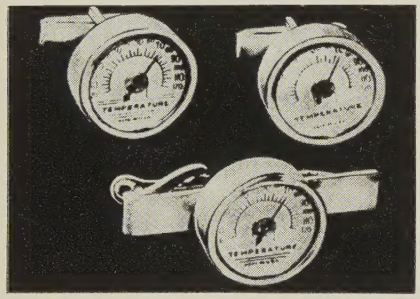
Advertising Sales Offices: See page 88.

From the Editor

Opinions and Rambling Thoughts

Cool Jewels

Because we publish a magazine, we probably get more than the normal share of mail that is destined for the waste paper basket. However, we do glance very quickly at all mail before tossing it aside. Normally a news release on tie clasps and cuff links would merit only one fleeting glance but we must admit that we were intrigued with the possibilities of the jewelry described in a recent announcement and shown in the photograph. Sold



by Zinn Originals of New York City, the thermometer tie clasps and cuff links are calibrated from —20°F to + 120°F and it is claimed that they are sensitive to within one degree. There are some commercial temperature measuring device manufacturers we know who are far from achieving such consistent accuracy—and their rather cumbersome units would look and feel rather awkward if converted to cuff links or a tie clasp. We imagine that engineers will find many uses for the Zinn jewelry. For example, an engineer now need only walk into a baking oven and look down in the vicinity of his necktie in order to check the temperature. If the engineer lives through the preceding use, he would be fully equipped to take a job as an arctic weather observer —in such an event, he would be able to dispense with complex weather instruments, provided he remembered to wear a shirt with French cuffs.

We're Getting Old

Often, we get so wrapped up in the mechanics of our work—such as getting each issue of *Insulation* on and off the press and into the mail—that we overlook matters of some significance and importance. For example, last month marked the beginning of *Insulation's* sixth year of publication, an event which at least holds some significance for the writer. The reason that this was not mentioned in the May issue was entirely a case of forgetfulness . . . an affliction of our advancing age. And even though it is a month overdue, we can't resist the urge to publicize the record of the past five years, so bear with us.

Our work habits haven't changed—this column is being written at 5 am on the copy deadline date—after five years, you'd think a man would learn how to plan his work but such is not the case.

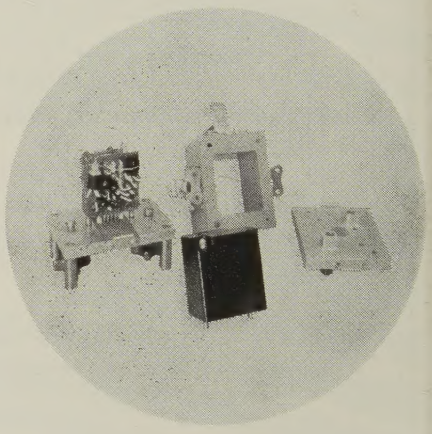
And the squeaks in the office chair are more maddening than ever. Half a decade of squirting oil at the monstrosity has been to no avail. However, the desk is just as functional and graceful as always—it is one of those ugly period pieces—from a period not old enough to be an antique and not young enough to permit foisting it off on anyone else.

The office girls are prettier but I fear this is because I have aged half a decade and they have not.

But probably most important is the fact that the magazine is many times bigger than it was five years ago. This is entirely due to the fact that advertisers have recognized the value of reaching the market that you, the reader, represent . . . for which, our sincere thanks. And to carry this idea one step further, thanks for knowing how to read.

The Cover

This month's cover shows a circuit, mold, and polyurethane embedded circuit. It is designed to introduce



the article in this issue by F. T. Parr, Air Arm Div., Materials and Processes Engineering Dept., Westinghouse Electric Corp., titled, "Low Density Fillers for Epoxy Resins for Embedding Airborne Electronic Circuits." The article is an excellent and thorough presentation. Author Parr reaches the conclusion that phenolic microballoon filled epoxy resin may be used successfully in certain situations.

Another article which is sure to be of interest to many readers is by F. Polenz of West Germany whose work has previously appeared in *Insulation*. His article is titled "A Study of the Thermoplastic Behavior of Enameled Magnet Wire." You'll also find interesting features in this issue on insulation testing, results of a solidifying fluid insulation survey, post-forming of laminated plastic parts, and other subjects. Be sure to read all of them.

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TUBING and SLEEVING
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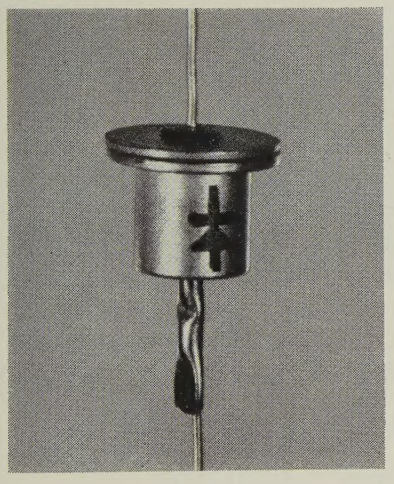
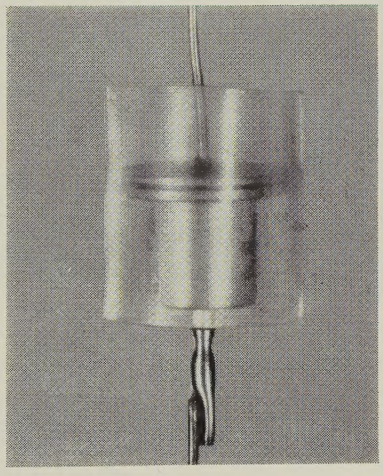
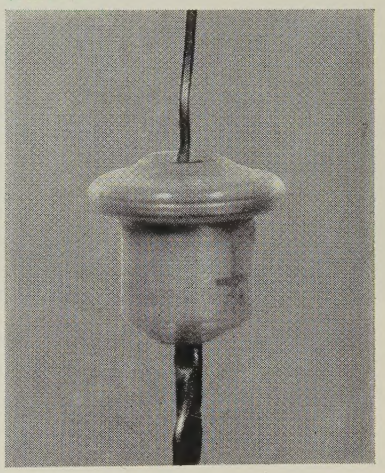


WITH THERMOFIT TFE



SHRUNK



Thermofit TFE, a transparent modified polytetrafluoroethylene, applied to a miniature diode protects against corrosion and insulation failures at high temperatures. Encapsulation is quick, efficient, permanent and transparent. Stock sizes range from AWG 30 to 0.

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News And Views

Dielectric Gas Price Slashed

Du Pont, as is its custom, has announced a drastic price reduction simultaneously with a move from pilot plant production to semi-commercial production for "Freon-C318" octafluorocyclobutane. The most important present use for the material is as a dielectric gas. When it was first offered in research quantities in 1958, the compound was priced at $20 per pound—the price reduction just announced is in the range of 75 percent bringing the figure down to $4.84 or $6.65 per pound depending on quantity. See *New Product* item No. 102 in this issue for more details.

Insulation Conference Progress

Shown in the photograph are some of the hard-working members of the General Conference Committee for the 1960 Insulation Application Conference at a recent planning session held in Chicago. Reports by committee chair-

men indicate that considerable progress is being made in all the various aspects of the conference, scheduled for December 5-8, 1960 at the Conrad Hilton Hotel in Chicago.

According to program chairman Thomas Hart, Silicones Div., Union Carbide Corp., about one-quarter to one-third of the excellent papers which have been offered will have to be turned down because of time limitations. The technical program is slated for Monday through Wednesday (except for Tuesday afternoon), Dec. 5-7. Four sessions each will be devoted to distribution and control apparatus, electronics and communications equipment, and rotating machinery with other sessions also planned on testing and evaluation and insulation fundamentals. Each session will be keyed with a specific theme.

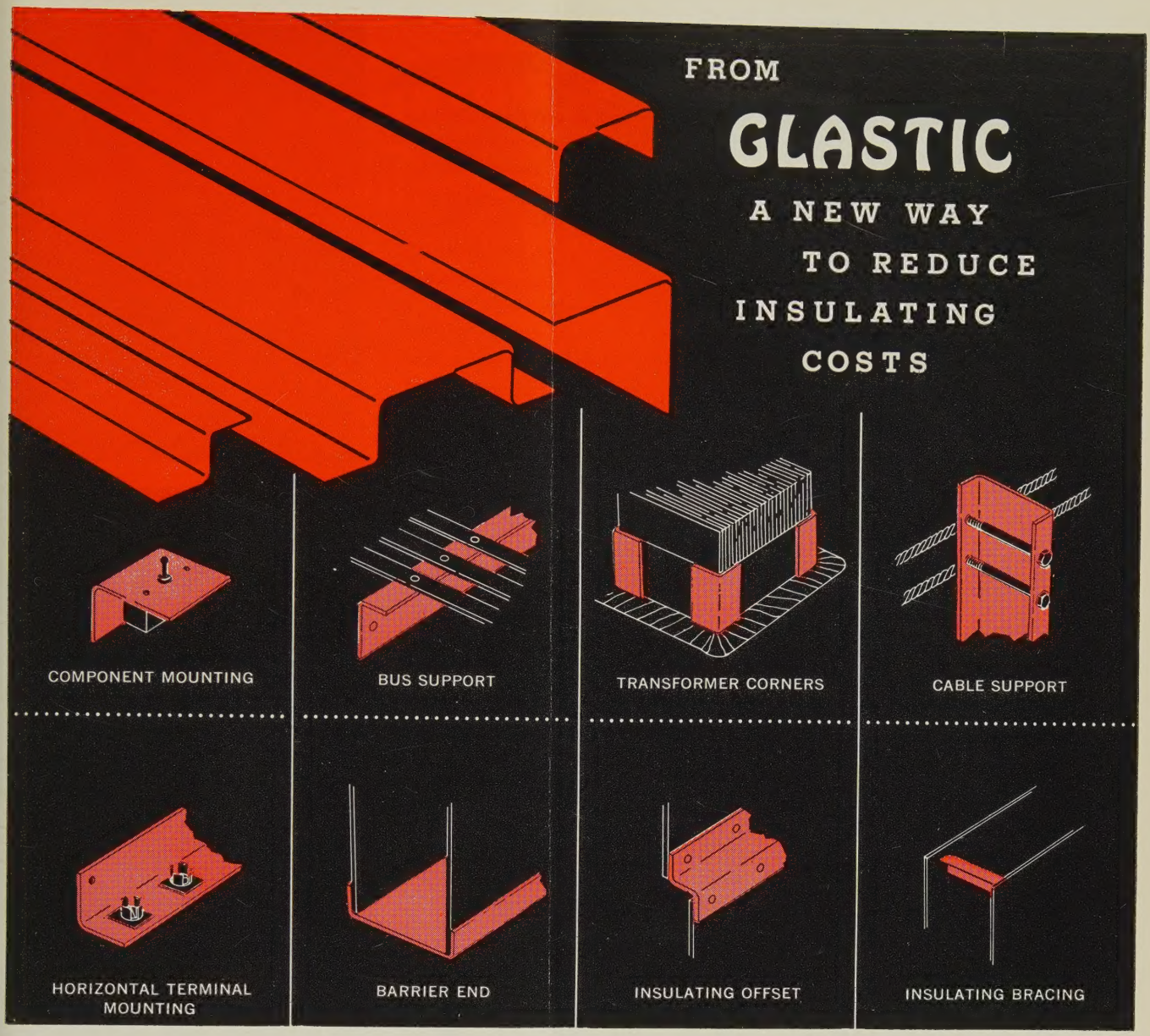
Under the direction of E. J. Phelan, Prehler Electrical Insulation Co., the insulation marketing group is arranging for two sessions. The first, which will cover basic insulation engineering fundamentals, will be held Tuesday, Dec. 6, under the chairmanship of Graham Lee Moses, Westinghouse Electric Corp. This session is expected to appeal to purchasing agents, insulation sales personnel, students, and others who lack deep knowledge of insulation materials and practices. The fundamentals of both materials and applications will be covered. The second session will be held Thursday morning, Dec. 8. Present plans call for A. L. Baldock, General Electric Co., to speak on "How to Introduce a New Product"; Charles P. Mills, Minnesota Mining and Manufacturing Co., to talk on "How to Make an Insulation Market Research Analysis"; and Thomas Keegan, Federal Insulation Co., to discuss "How the Customer Should Treat the Salesman." A change-of-pace skit is also planned on "How Not to Sell Insulation"—actors are to be Robert E. Joseph, Allis-Chalmers Manufacturing Co.; William Carlstrom, Insulation Manufacturers Corp.; and W. R. Swenson, Minnesota Mining and Manufacturing Co. A noted luncheon speaker will also be announced shortly.

Exhibit chairman Arnold Bohn, Dow Corning Corp., has reported that 135 booth spaces will be available for sale to insulation material, test instrument, and processing equipment producers. All booths are expected to be sold quickly because of the limited number available.

The conference, which is co-sponsored by the National Electrical Manufacturers Association and the American Institute of Electrical Engineers, is under the general chairmanship of William Hoffer, Johns-Manville Corp. Roger White, The Glastic Corp., and Michael Nakonechny, Dow Corning Corp., are vice-chairmen. Recently elected members of the executive committee are: Kenneth Mathes, General Electric Co.; Emanuel Brancato, Naval Research Laboratory; Walter Hugger, Sun Chemical Corp.; Charles Leape, Westinghouse Electric Corp.; Carl Christiansen, recently with Dow Corning Corp.; Harry Chapman, Owens-Corning Fiberglas Corp.; Joseph Perkins, E. I. du-Pont de Nemours & Co.; Lincoln R. Samelson, Lake Publishing Corp.; and Hoffer.

Biggest Diameter Conductor Being Tested

The world's largest-diameter electrical power transmission conductor, designed by Aluminum Company of America, is now being tested and evaluated at Alcoa Laboratories in Massena, N.Y. Destined for use on the project EHV (extra high voltage) prototype transmission system now being constructed near Pittsfield, Mass., the conductor is 2.32-inch diameter ACSR (aluminum conductor, steel reinforced). Sponsored by General Electric, the experimental project will eventually transmit power at 750,000 volts, highest in the world. The new conductor will be tested at 460,000 to 500,000 volts which is expected to be the next step in transmission voltages.



Use versatile channel/angle stock for design flexibility, simplified assembly

The illustrations show typical ways in which Glastic insulating channel and angle stock can serve as product-improving replacements for heavier or more expensive forms—stand-off insulators, wood or insulated metal members.

The high strength stock is available off-the-shelf only from Glastic. It comes ready-to-use in 10 sizes, in widths to 9⅝" and lengths to 76". It can be easily fabricated to meet individual job requirements.

Glastic structural stock is molded of fiber glass reinforced polyester and is engineered for use in equipment operating at Class B temperatures (130°C). It has UL-recognized flame retardance, and properties meet NEMA GPO-1 specifications.

Investigate the cost-saving possibilities of these easy-to-use insulating shapes in your applications . . .

SEND FOR COMPLETE DATA

"Insulating Channel and Angle Stock" Catalog contains application, engineering and price information. Companion catalog describes Glastic line of low cost insulators.

THE GLASTIC® CORPORATION

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Precision Circuit Board Drilling

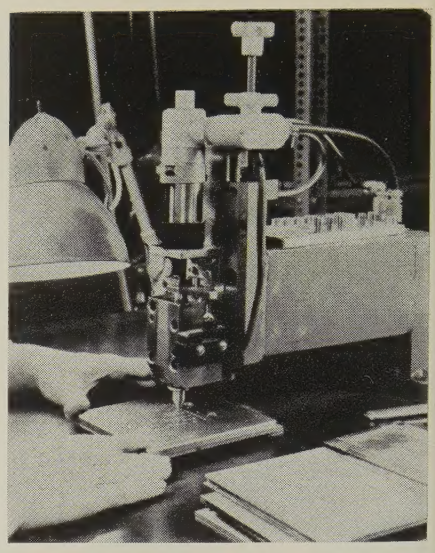
A new method of precision drilling circuit boards with semi-automatic equipment has been announced by Librascope Div., General Precision Inc., Glendale, Cal. The new "gang" drilling produces circuit boards which are suitable for machines which automatically insert components.

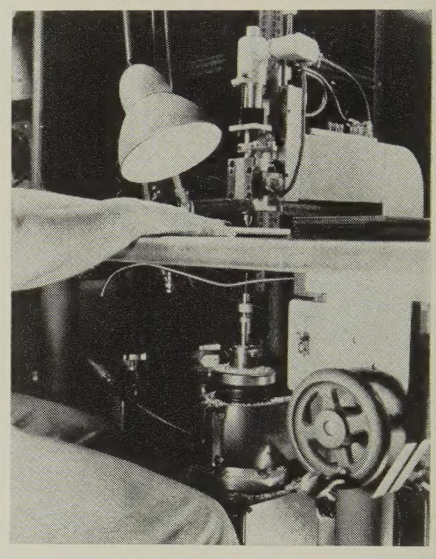
The development of precise drilling techniques was necessary when Librascope switched over to automated component assembly methods. Holes for mounting components by machine must be drilled with extreme precision to insure that the machines are able to place each lead correctly. The semi-automatic drilling equipment was designed by the division's own industrial engineering department. Since the new equipment was installed, reject rates have dropped drastically, and output of drilled boards per operator has risen.

The semi-automatic drill consists of a table, a special positioning "finger" located above the table, and an electrically controlled drill below the table.

An operator gangs five circuit boards by placing them in a special positioning fixture. This fixture is a rigid metal plate, backed by reinforced plastic. The surface of the plate contains a drilling "pattern" etched into the metal, with positioning indentations to correspond to the hole to be drilled. The five boards are held in alignment by holes which are precision drilled before the circuit boards are etched.

The fixture, with the boards, is placed, metal plate up, on the drill table, and the special positioning finger is guided along the drilling pattern by the operator. As the finger drops into each indentation in turn, the operator touches a toe switch and a special carbide drill, located below the table, does the drilling. The drill is completely automatic, rising at a controlled rate and spinning at a preset speed. The process is provided with safeguards, which prevent the drill from operating unless the positioning finger is located directly in the center of an indentation on the fixture's pattern.





All five boards are drilled at the same time, and the drill "bottoms" in the reinforced plastic backing of the fixture. At the completion of the "stroke," the drill returns to the rest position and the finger is guided by the operator to the next indentation.

Coordinate Time and Frequency Transmission

The United Kingdom and the United States have begun coordination of their time and frequency transmissions. Coordination should help in the solution of many scientific and technical problems in such fields as radio communications, geodesy, and the tracking of artificial satellites. It is expected that by the end of 1960 the time signals from all the participating stations will be emitted in synchronism to the thousandth of a second.

ONE INTEGRATED SOURCE for Ceramic-to-Metal Seals

Standard types of Alite high voltage bushings are available in various sizes and configurations.

In *all* phases of planning for ceramic-to-metal seals—from design to finished assembly—you can rely on ALITE for the know-how and "*do*-how" required to produce highest quality ceramic-metal components for critical applications.

High alumina Alite is the ideal material for making rugged, high performance hermetic seals and bushings. It has superior mechanical strength, high temperature and thermal shock resistance, plus reliable electrical characteristics. Our complete high temperature metalizing and bonding facilities assure delivery of the finest seals available—mass-spectrometer tested for vacuum-tightness.

Please contact us for valuable performance data and information regarding ceramic-to-metal applications . . . no obligation.

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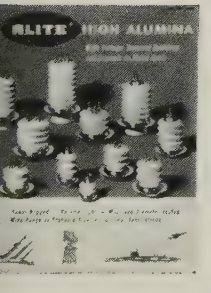

Fact-packed, illustrated Bulletin A-40 gives vital technical data and product information. Write today.

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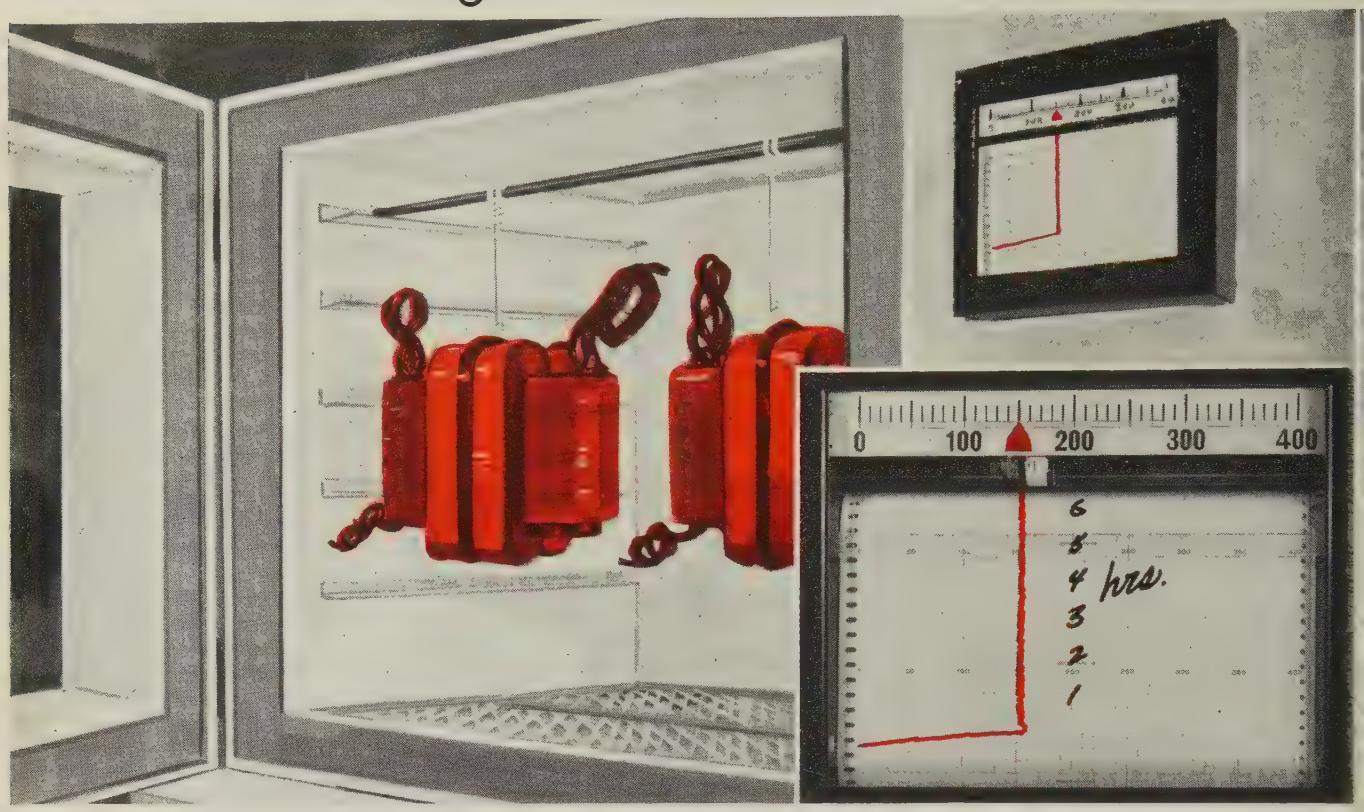
New Easy-To-Use Varnish



New Dow Corning Varnish simplifies processing of Class H Transformers

An all-new Dow Corning Silicone Varnish opens a new era of easier, quicker, lower-cost processing of silicone insulation systems for transformers. An example of its cost-saving advantages: this new varnish cures in only six hours at 150 C . . . develops its bond strength at 50 C less than conventional silicone varnishes.

Now, because of this new Dow Corning Silicone Varnish, transformer builders equipped for Class A or B insulation systems are *automatically* equipped for Class H as well!

And there are other advantages too! Runoff is very slight. Compared to other varnishes, new Dow Corning 980 Varnish gives adequate buildup to the desired insulation thickness while reducing varnish waste . . . cleanup time. Big savings in processing time and equipment maintenance can be achieved.

Heat stability is even better than for silicone varnishes previously available. This new Dow Corning Varnish meets AIEE heat stability requirements for 220 C systems, resists moisture and is unaffected by many corrosive atmospheres.

When used with other silicone components in units designed for higher temperature rise, Dow Corning Silicones help make transformers smaller, lighter, safer, more reliable and virtually maintenance-free. Write today for complete data on this new cost-saving silicone varnish.

Other Cost-Saving Advantages:
In addition to curing in 6 hours at 150 C, Dow Corning 980 Varnish has excellent tank stability and will not soften, swell or

deteriorate most insulating materials, including silicone rubber. The varnish affords good penetration and will not drip off coils or handling equipment to create a maintenance problem. Lower curing temperatures, less runoff plus other economies substantially reduce insulating costs.

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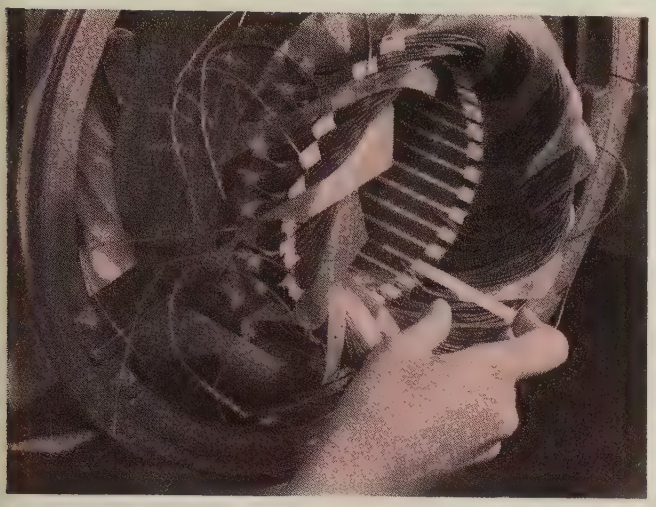
Your nearest Dow Corning office is the number one source for information and technical service on silicones.

first in silicones

Dow Corning

...other silicones aid performance



Silicone-Glass Laminates Stay Strong

Slot sticks made of silicone-glass laminates assure this Allis-Chalmers 2-hp, 3-phase, 1750 rpm motor maximum reliability, long service life in high ambient temperature applications. A typical application for this motor is on oven door opening devices where the ambient temperature is 250 F.

Silicone-glass laminates retain their mechanical strength, high arc resistance, low loss factor and low moisture absorption even after prolonged aging at 250 C . . . provide ideal structural-insulating properties.

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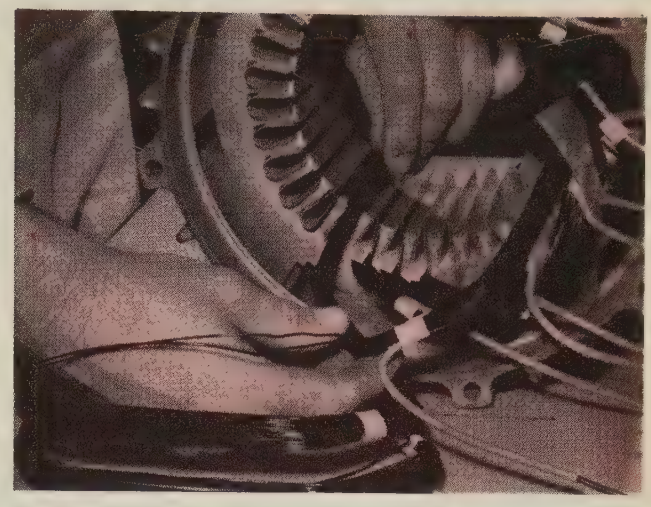

Sylkyd Enameled Magnet Wire Cuts Bulk

Easy-to-install Sylkyd® Enameled Magnet Wire eliminates needless bulk in high temperature insulation systems. Sylkyd coated wires are comparable in diameter to Class A insulated wires . . . allow a higher copper to iron ratio than fibre covered, high temperature wires . . . permit designs that supply maximum power per pound. They are performance-proved in 180 C insulation systems . . . will resist most chemicals, moisture, corona, dirt and many other environmental hazards. Sylkyd has long shelf life — won't craze, soften or become brittle in storage.

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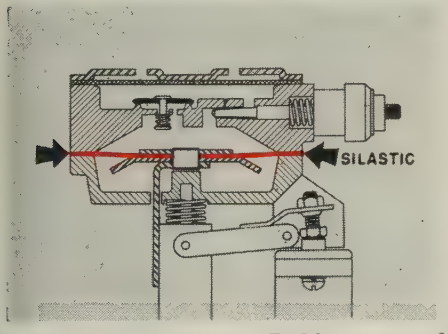
Silastic Assures Timer Accuracy



Even a minute change in the elasticity of the rubber diaphragm in this Square D pneumatic time-delay relay would adversely affect accuracy. That's why heat-and-cold-resistant Silastic®, the Dow Corning Silicone Rubber, was selected. This sensitive diaphragm enables the timer to give accurate delays ranging in duration from .05 seconds to 3 minutes . . . regardless of changing climatic conditions. Parts molded from Silastic are exceptionally resistant to weathering, oxidation, ozone and temperatures from —70 to 250 C. They are available in almost any size, shape or color from leading rubber fabricators.

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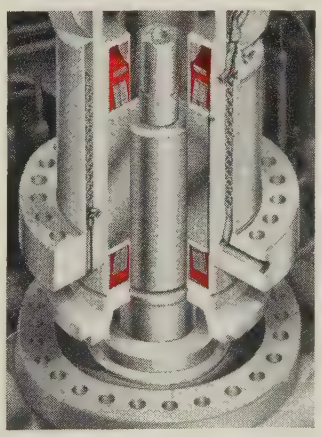
Silicone Resin "Locks In" Performance



Designed for maximum reliability, new Westinghouse removable stator canned motor-pumps like this one are used for better boiler circulation in controlled circulation conventional systems. Similar pumps are used to circulate radioactive liquid coolants at temperatures up to 650 F in hermetically sealed primary coolant systems of nuclear reactors.

End turns of stator coils are potted in Dow Corning solventless silicone resin to insure a solid, void-free fill of coil interstices. These solventless resins are radiation resistant, withstand vibration, oxidation, corona and moisture despite continuous service at high temperatures.

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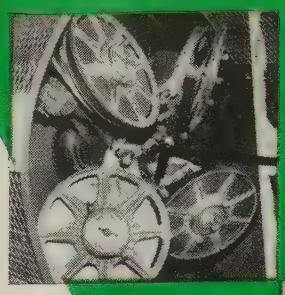
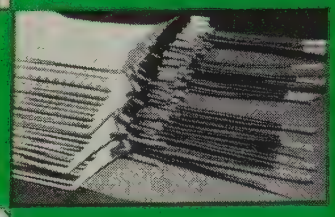
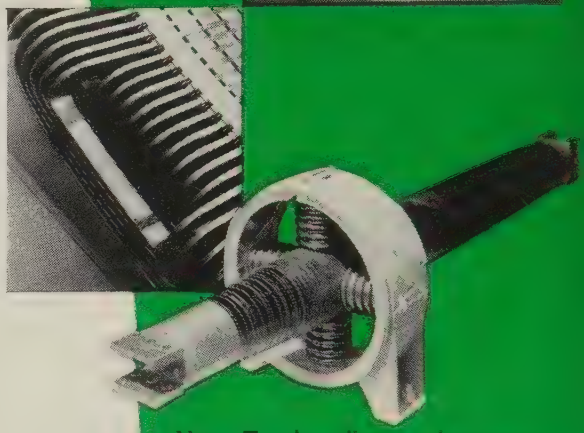
Natvar TERAGLAS*

A NEW CLASS B INSULATION HAS RESILIENT WEAVE AND HIGH DIELECTRIC STRENGTH UNDER STRETCH







Natvar Teraglas is a new flexible insulating material comprising a base fabric, woven from polyester (polyethylene terephthalate, or "Dacron") warp yarns and continuous filament glass filler yarns, coated with an improved varnish, possessing exceptional dielectric strength under elongation. It will withstand Class B (130°C) operating temperatures.

In view of the higher dielectric strength of Natvar Teraglas compared to bias varnished cambric, thinner sections or fewer layers may be used to provide the voltage breakdown protection desired. Consequently, at comparable tape prices, a significant saving may be realized in production costs, while permitting up-grading to Class B (130°C) temperatures.

Natvar Teraglas is available in two thicknesses, .010" and .012"—in tapes, in full width rolls (36"), or in sheets. Ask for Data Sheet and Samples.

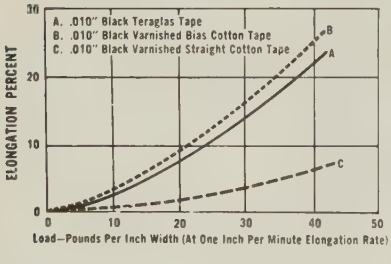
Natvar Teraglas will prove advantageous in many applications — for insulating motors, generators, transformers, cables, switchgear, busbars, and other apparatus and equipment where resiliency and high dielectric strength are desirable.

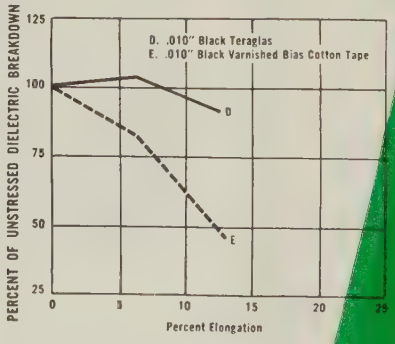
TYPICAL DATA

Physical Properties:		.010"	.012"
Approximate weight per sq. yd., lbs.		0.54	.62
Breaking Strength lbs./in. width,	Warp	45	45
	Filler	100	100
Tear Strength, grams	Warp	Over 1000	Over 1000
	Filler	Over 1000	Over 1000
Elongation, % (Under 25 lbs./in. width—3 minutes)		7.5	7.5

Electrical Properties:	.010"	.012"
Electric Breakdown Strength (C48-23-50 V/M)	1600	1600
Electric Breakdown Strength (Under 6% stretch)	1600	1600
Electric Breakdown Strength (Under 12% Stretch)	1450	1450
Power Factor, %, at 80° C-50 V/M-60 c.p.s.	2.5	2.5

LOAD-ELONGATION CHARACTERISTICS FOR NATVAR BLACK TERAGLAS





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Insulation Tests

Flagging of Pressure-Sensitive Tapes

These articles by H. K. Graves, Supervisor, Electrical Insulation Section, Materials Laboratory, New York Naval Shipyard, are designed to explain the purpose, reasons, operations, meaning, and interpretation of results, etc., behind various tests for electrical insulation. Mr. Graves is also chairman of Committee D-9 on Electrical Insulating Materials of the American Society for Testing Materials.

Some time ago, one company had a very discouraging and expensive experience with a large shipment of vinyl backed pressure-sensitive electrical insulating tape which involved the expressing of some rather strong opinions about the particular material and vinyl tapes in general by electricians using the product. As a result a method was developed by one laboratory to measure the tendency of these tapes to unwind (flag) after they are wrapped around small diameter objects. This very undesirable characteristic has probably been noticed by many users in the electrical insulation field as well by those handymen who use vinyl tape around the home.

In developing the method, many combinations of good and poor tapes, various mandrel sizes, and wrapping tensions were studied. It is apparent that backing stiffness and thickness are large factors in flagging tendencies. It is also apparent that rather than measuring conventional adhesive strength, we must measure the slow pulling away and failure of the adhesive under a long applied force.

The method developed consisted of applying a spiral wrap of tape on a small metal mandrel with one end of the tape released to allow unwinding. Since, in use, the outer end of tape is often secured to the backing of an inner layer of tape, work was also done with a spiral tape wrapped mandrel, having both tape ends secured, over which a second layer was wound with only one tape end secured while the other was free to unwind.

After presenting the method to the ASTM section on pressure-sensitive insulating tapes, round robins were conducted, improvements were made, and the various parameters were standardized. It was decided that unwinding from its own backing was the more critical condition and represented the majority of applications.

The method became a part of ASTM Designation D1000-59T, Tentative Methods of Testing Pressure-Sensitive Adhesive Coated Tapes Used for Electrical Insulation. At present, it is applicable only to class 2 tapes, those with elastoplastic backings, although it would appear to be useful for class 1 nonelastic tapes where flagging problems are relatively rare but may occur occasionally. Of course, the problem is much greater in elastic backed tapes since they are normally stretched in application and a considerable shear stress is set up in the adhesive. This shear stress also tends to make the tape curl away from the object around which it is wrapped.

The method describes the term "flagging" as the lifting of the terminating end of a wrapping of tape to form a flag or tab. In the case of poor tapes, flagging will be represented by the wrapped tape becoming partially or completely unwound. The method states that a knowledge of flagging characteristics is useful in determining whether such properties as thickness, stiffness, and adhesion have been properly balanced for applications where flagging may occur.

The mandrel is a straight, clean ⅛-inch brass rod of the specified length. A simple, hand operated winding jig is described which, when tilted at about 35 degrees to the horizontal, will permit winding a single layer of tape on the mandrel without lapping of turns or creating space gaps between adjacent turns. A weight to provide the winding tension is specified and varies with the tape thickness. A simple board with ⅛-inch holes serves as the holder for any number of wrapped specimens after winding.

Test specimens ¼-inch wide and of the specified length are cut from a sample of tape. Considerable care is required in the cutting and winding operations to make sure that neither the hands nor any other objects contact the adhesive of the tape test section. The method recommends a ¼-inch wide die for cutting specimens with the specimens cut adhesive side up.

One end of the tape specimen is tied to the ⅛-inch mandrel near one end. The specified weight is then attached to the lower end of the specimen and allowed to hang for one minute, to produce some elongation in the tape. The elongation initially will increase for several seconds but will normally have almost ceased after one minute. Experience showed that if the winding was started immediately after attaching the weight, the lower end of the tape would be narrower than the upper end, making it necessary to shift the mandrel angle during winding to produce the required uniform wrap.

As mentioned, the mandrel angle is adjusted to give uniform butted wrap on the mandrel when the mandrel is slowly rotated. Until experience is gained with a particular tape, it may be necessary to discard one or two specimens until the proper angle is found. After the wrap is complete, the lower end of the tape is tied to the

mandrel and the surplus cut off.

A second specimen of tape is then secured near the upper end of the mandrel. The weight is applied and the tape is wound as for the first layer but it is positioned to half-lap the first layer tape turns. As the winding nears the lower end of the mandrel, a short strip of $\frac{1}{8}$-inch wide lens tissue is inserted under the tape parallel to the axis of the rod. This serves to terminate the winding in a reproducible manner so that the weight can be removed and the remainder of the tape cut off adjacent to the tissue. The narrow strip of tissue then serves as a bench mark to measure the length of flag as the tape unwinds.

The rod is inserted in a hole in the board with the flag at the upper end and covered so that it remains draft-free for seven days under standard laboratory atmosphere of 23°C and 50% relative humidity. At the end of this period, the distance from the point of tangency of the flag to the nearer edge of the tissue is measured, taking care not to cause any additional unwrapping in measuring. The maximum, minimum, and average lengths of unwind are reported as a measure of flagging.

If considerable care is used in the measuring operation, repeated measurements can be made periodically and the unwinding characteristic of the tape plotted with time. Experience has shown that commercial tapes vary all the way from no measurable flag (less than 0.01-inch) to complete unwinding or to the point where the unwound end rests on the supporting base. After only limited experience, the method yields reproducible results and would appear to measure the desired characteristic directly. To some readers the diameter of the mandrel may appear unreasonably small, but it should be noted that some specimens of good tape have been left for months and a few for years with no measurable flagging.

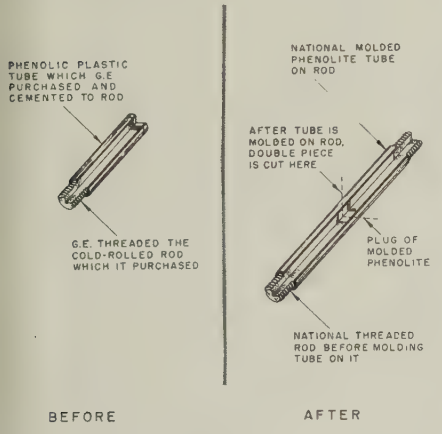
A point of interest to users of these tapes and one which the manufacturers attempt to publicize is that in using these elastoplastic tapes, the last inch of the winding should be applied without tension to relieve the shear stress in the adhesive and to minimize the flagging tendency.

Brush Holder Stud Cost Cut 74%

General Electric Co. has cut the cost of its brush holder stud 74 percent by having it made outside. Yearly savings amount to $3000.

Formerly, G-E fabricated the studs from two materials purchased outside —steel rods and pre-cut phenolic tubes. The rods, 4 or 5 inches long, were threaded on one end, and inserted into the phenolic tubes. The tubing was allowed to extend 3/8-inch to prevent the stud from making contact with other metal parts. Because of variation between the outside diameter of the steel rod and the inside diameter of the phenolic tube, a uniformly tight fit was not possible. As a result, G-E had to cement the tube to the steel bar, a costly operation. Average cost per stud was $1.74.

In a new approach, G-E had National Vulcanized Fibre Co. mold the



tube on to the steel stud. National was able to produce the brush holder stud at 70 cents instead of G-E's cost of $1.74.

The tubing is molded on the two steel studs simultaneously. Studs are threaded prior to being encased. During the molding operation, the unthreaded ends of the studs are separated by 3/4-inch. After the tubing has been applied, the tube is cut, separating the two studs. This production technique permitted further improvement of G-E's previous design by incorporating a molded phenolic plug into the tube extension at the unthreaded end of the stud. This design feature shields brush holder stud from electrical contact with other metal parts.

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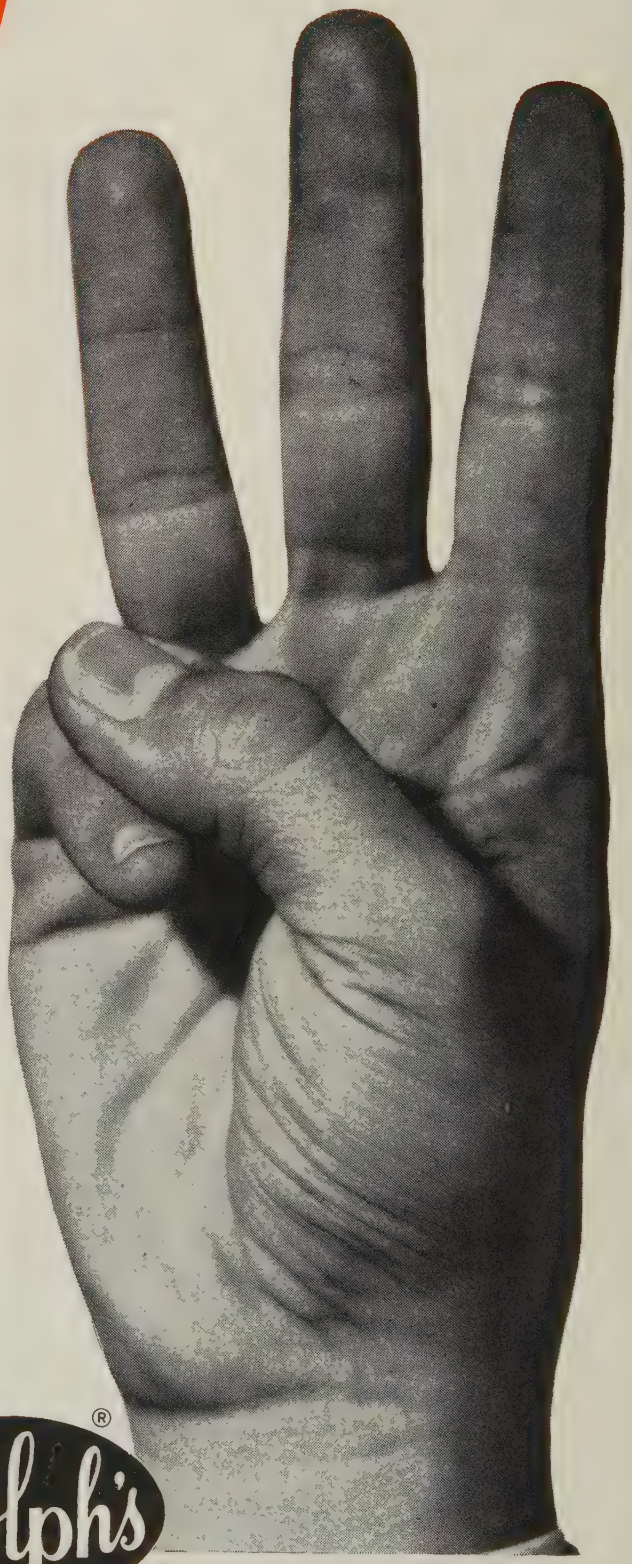

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Directory / Encyclopedia Issue of Insulation *To Be Published*

As a result of numerous requests from both users and producers of electrical and electronic insulation materials, insulated products, processing equipment, and testing apparatus, Lake Publishing Corp. plans to publish an annual directory/encyclopedia for the industry.

The directory/encyclopedia will be published separately from the other issues. Publication target date is May 1961. The annual publication will serve as a directory by listing all the known and verified producers, fabricators, and distributors of insulation materials, wire, cable, production equipment, test instruments, and related products. Listings will be as complete as possible giving all the information required by the men who design, buy, and specify these products.

Just as important as its directory listings is the fact that the new publication will serve as an encyclopedia or user manual for everyone concerned with insulation. Individual sections or chapters will be devoted to each type of material. Materials and equipment will be evaluated and described. Information will be provided on applications, properties, forms available, test data, standards, specifications, engineering societies, recent developments, manufacturing and processing methods, etc.

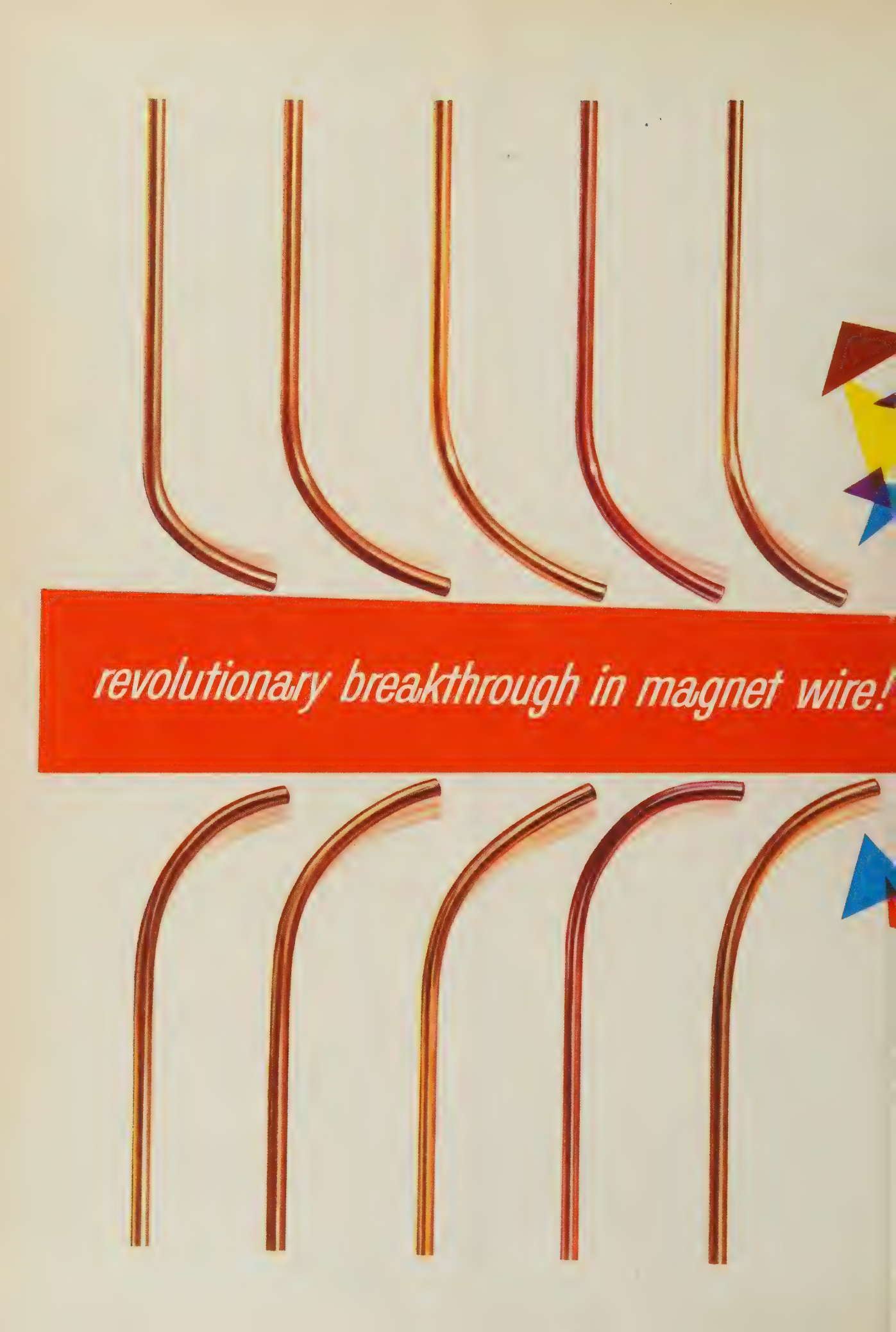
To help in the preparation of the directory/encyclopedia, the technical assistance of individuals in the field and technical societies is solicited. It is anticipated that the directory/encyclopedia will become the most useful reference in the industry.

When published, the directory/encyclopedia will be supplied to all *Insulation* subscribers. The directory/encyclopedia will provide an ideal opportunity for advertising by the many suppliers of the industry—instead of standard advertisements, the publishers are recommending the insertion of complete catalog type multiple page advertisements on a company's complete line of products so that the publication may justify its function as the most thorough source of reference information on electrical/electronic insulation in existence.

Advertising rates for the directory will be identical to those for *Insulation*. Insertions in *Insulation* will count toward earning a better advertising rate in the directory/encyclopedia but insertions in the directory/encyclopedia will not count toward earning a better rate in *Insulation*.

The directory/encyclopedia will be organized into logical sections or chapters covering specific types or groups of materials, forms, or applications. In all likelihood, advertisers will have the opportunity to specify the sections in which they wish their advertising to appear.

Each year, the directory/encyclopedia will be revised as thoroughly as necessary to bring it up to date and to incorporate information on the latest developments in the insulation field. Every effort will be made to continually improve it.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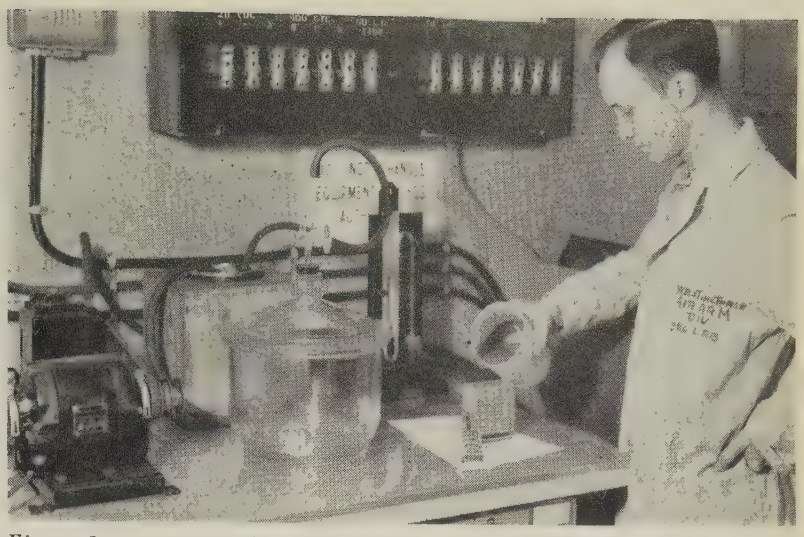

Figure 1, operator performing embedment process with laboratory equipment

Low Density Fillers for Epoxy Resins For Embedding Airborne Electronic Circuits

By F. T. Parr, Air Arm Div., Materials and Processes Engineering Dept., Westinghouse Electric Corp., Baltimore 3, Md.

Selection of proper insulating materials is one of the most important considerations in building military airborne electronic equipment. Manufacturers of this gear recognize that such adverse environmental conditions as humidity, salt spray, thermal shock, fungus, and vibration are major factors affecting the life of the equipment and the electrical insulating materials used.

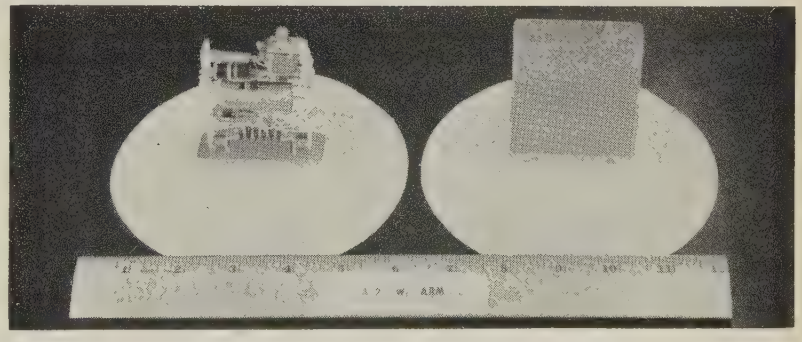

Figure 2, unembedded assembly, and assembly embedded in epoxy resin

In much airborne electronic circuitry, the dual task of providing protection against these environmental conditions and of meeting electrical insulation requirements is accomplished by embedding or casting the circuits in casting resins such as polyester, epoxy, silicone, or other resin systems.

This process is carried out by positioning the circuit to be embedded in a metal or plastic mold, and pouring a catalyzed pre-evacuated resin compound into the mold so as to surround and embed the circuit. The process as it is performed in the lab is shown in figure 1. A vacuum is then drawn on the assembly in a bell jar to remove entrapped air. After the vacuum is broken, the mold containing the circuit and resin is then placed in an air-circulating oven to cure.

At the end of the curing cycle, the cast part is removed from the mold (figure 2). At this point, the circuit is hermetically sealed and protected for the most part against the environmental conditions of shock, humidity, fungus, salt spray, and vibration. The degree of this protection is dependent upon the particular resin system used.

Less Weight Reduces Costs

Since the properties of the embedding resin system are highly influential in determining the operating life and reliability of the equipment, there is a constant need for resin systems that provide better environmental protection and insulation. There is

also an urgent need to make this equipment as light in weight as possible. To illustrate, a recent study by an aircraft manufacturer showed that for each pound of equipment to be borne aloft in a particular aircraft, 14 additional pounds of aircraft and fuel are required. With the aircraft cost-per-pound given as about $51, this represents an over-all cost of $765 per pound of airborne equipment. It is interesting to observe that if one pound of a casting or embedding resin formulation could be saved, it would be worth more than the value of a pound of gold, which is about $420. A further cogent argument for weight reduction is that weight tends to reduce the range and performance of the plane or missile. Toward this end, we have investigated the possibility of achieving lower weight embedded electronic circuits through the medium of lower density fillers in epoxy resins, and the use of polyurethane foam resins for embedding applications.

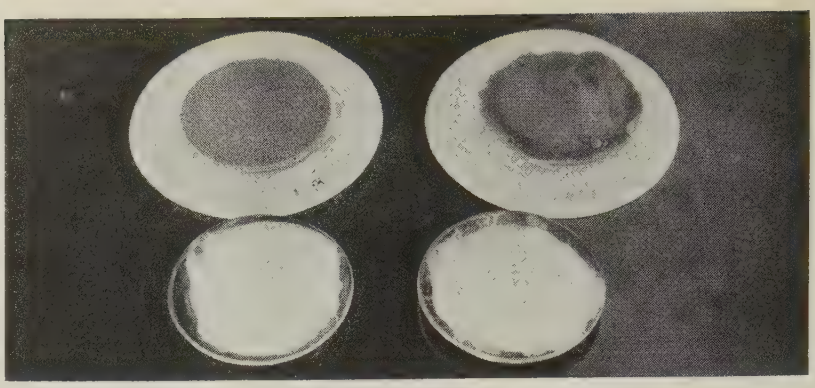

Figure 3, four low density fillers, Kanamite, phenolic microballoons, glass microballoons, and Colfoam

Embedment Resin Systems

At present, epoxy resins are accepted as the most suitable for embedding and casting because of inherent properties such as excellent chemical resistance, minimum moisture absorption, superior adhesive quality, low shrinkage during cure, exceptional mechanical properties, satisfactory electrical characteristics, and the capability of forming large castings.

Generally speaking, however, an epoxy resin and catalyst system without a filler will lack certain physical and electrical properties, but the lack can usually be corrected by including a suitable filler which normally possesses a lower coefficient of thermal expansion than that of the resin. The coefficient of thermal expansion of the resin and filler is altered, thus increasing the ability of the system to withstand thermal cycling.

The formulation that was settled on by Westinghouse in the early 1950's, when filled epoxy resin systems came into use, was based on Epon 828, 325 mesh silica, and Shell curing agent D (2 ethyl hexoic acid salt of tri-dimethyl aminomethyl phenol). This formulation was expected to perform satisfactorily over a temperature range of +85°C to —55°C. A formulation of equal quantities of resin and silica was

Table 1, Low Density Fillers

No.	Name	Description	Particle-size	Bulk Density	Mfr.
1	Kanamite Grade 200	Unicellular Hollow clay spheres Primarily Alum. Silicate	90% 35-60 mesh 10% 20-100 mesh	0.9 Grams per ml.	Ferro Corp.
2	Colfoam Microballoons	Urea-Formaldehyde Spheres	90% 20-100 mesh 10% Through 200 Mesh	0.2-0.5 grams per ml.	Colton Chemical Co.
3	Microballoons BJOA-0840	Hollow Phenolic Spheres	10% 40-100 mesh 74% 40-200 mesh 16% Through 200 Mesh	0.3-0.4 grams per ml.	Union Carbide Plastics Co.
4	Microballoons CPR 2077	Hollow Glass Microspheres	89% 60-325 mesh 11% Through 325 mesh	0.26 grams per ml.	Standard Oil of Ohio
5	Silica Powder*	White Powder Containing 99.86% Silica	39% 80-325 mesh 61% Through 325 mesh	2.32 grams per ml.	Harshaw Chemical Co.

**This filler, which is not considered low density, is included for comparison purposes.*

found to possess satisfactory physical and electrical properties for the applications at hand. However, this particular formulation has a disadvantage for airborne applications in that it is comparatively heavy because of the large amount of silica in the formulation. Despite this shortcoming, the formulation was used for quite an interval.

More recently, when inorganic and organic hollow spheroidal particles in screen mesh sizes from 20 through 325 appeared on the market, it was felt that these materials could serve as low density filters for inclusion in epoxy resin systems. It was hoped that at least one of them could be included in an epoxy resin system to reduce the weight without any significant adverse effect on the physical and electrical properties of the epoxy resin itself.

Investigating Low Density Fillers

To pursue this possibility, we began investigations of four low-density fillers—Kanamite, Colfoam microballoons, phenolic microballoons, and glass microballoons. These fillers are pictured in figure 3 and described in table 1. Laboratory work was undertaken to develop formulations based on Epon 828, Shell curing agent D, and these low-density fillers. Since the viscosity of the mix was a factor acting to limit the rate at which evacuation could be completed, viscosity was kept below that of the silica filled system, which was a maximum of 48,000 centipoise at room temperature. With this in mind, formulations containing the percentages of filler as shown in table 2 were compounded for testing.

Thermal conductivity posed one of the biggest problems in the use of low-density fillers in epoxy resin formulations for embedment of electronic circuits. Specifically, it was necessary to determine whether the reduced thermal conductivity of the resin system which resulted from the use of these fillers would make that system unsuitable. Since embedded circuits usually contain subminiature tubes and resistors which generate appreciable amounts of heat during their normal operation, this heat must be conducted out of the package. It is for heat transfer, among other reasons, that fillers were originally incorporated into epoxy resin formulations for such applications.

Table 2, Weight Reduction Versus Fillers

Filler	Grams of Filler Per 100G Resin	Compound Density	Weight Reduction Over Silica Filled Compound (%)
Silica	100	1.59	0
Kanamite	34	1.01	36.5
Colfoam	4	1.01	36.5
Phenolic Microballoons BJOA-0840	15	0.86	46.0
Glass Microballoons CPR 2077	14	0.95	41.0

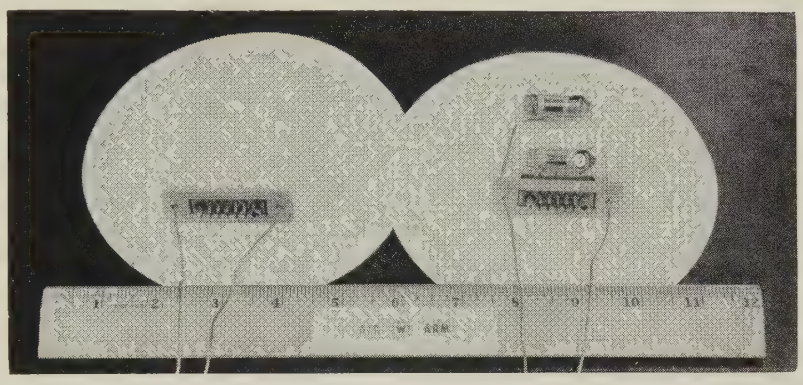

Figure 4, embedded and unembedded test circuits for determining thermal conductivity

Table 3, Comparison of the Hot Spot Temperatures of Unembedded Tubes With Those Embedded in Epoxy Resin Containing Various Fillers

Filler	Operating Unembedded Tubes at 23°C Ambient	Operating Embedded Tubes at 23°C Ambient	Operating Embedded Tubes at 82°C Ambient
Silica	100°C	75°C	112°C
Kanamite	100°C	85°C	125°C
Colfoam	100°C	100°C	135°C
BJOA-0840 Phenolic Microballoons	100°C	105°C	140°C
Glass Microballoons	100°C	95°C	129°C

Thermal Conductivity

To study this question of thermal conductivity, we made up five identical circuits containing two subminiature tubes (figure 4). Thermocouples were included to gather data on temperatures at the hot spots of the tubes.

These circuits were then embedded in each one of five resin formulations:

one contained 100 parts silica; another 75 parts Kanamite; another 4 parts Colfoam; another 15 parts phenolic microballoons; and the last 14 parts of glass microballoons. Each formulation was based on 100 parts of Epon 828 resin, catalyzed with Shell curing agent D.

When test circuits were operated in a closed box so as to minimize air circulation, we obtained the data of table 3, which shows a comparison between tube temperatures on the hottest tube of each unit unembedded and embedded. It can be seen from table 3 that use of silica powder filler results in better heat conductivity from the tubes than does the use of

Table 4, Table of Physical & Electrical Properties of Epon 828 Resin Containing Various Fillers

(Resin Formulation for All is 100 Parts Epon 828 and 10.5 Parts Shell Curing Agent D Plus Fillers Indicated Below)

Properties	No Fillers	100 Pts. 325 Mesh silica	15 Pts. BJOA-0840 Microballoons	34 Pts. Kanamite	4 Pts. Colfoam	14 Pts. CPR-2077 Glass Microballoons
Shrinkage, Linear	0.12%	0.08%	0.14%	0.06%	0.17%	0.25%
Hardness (After Cure) Shore "D"	80-85	80-85	80-84	75-80	80-85	80-85
Compound Density at 21°C	1.17	1.59	0.86	1.01	1.01	0.95
Tensile Strength psi (25°C)	8000	5500	3300	2000	4050	4200
Thermal Conductivity BTU/Hr/1°F/Ft²/in	2.68	6.38	1.91	2.47	4.15	4.56
Thermal Expansion Linear, in/in/°C (25° to 100°C)	8.7×10^{-5}	8.6×10^{-5}	8.2×10^{-5}	6.7×10^{-5}	8.6×10^{-5}	8.2×10^{-5}
Viscosity CPS (25°C)	13,500 to 19,500	43,000 to 48,000	34,000 to 38,500	34,000 to 39,000	45,000 to 48,000	44,000 to 47,000
Stress Index 10°C to −65°C (psi)		20.0	6.7	8.5	10.4	
Stress Index, 10°C to +85°C (psi)		28.0	9.1	13.3	10.5	
Dielectric Constant at 25°C	1 kc-3.8 1 mc-3.7	1 kc-3.4 1mc-3.4	1 kc-3.2 1mc-2.7			
Power Factor at 25°C	1 kc-.0035 1 mc-.015	1 kc-.003 1 mc-.012	1 kc-.003 1 mc-.014			
Volume Resistivity Ohms-cm	25°C 8.7×10^{14} 100°C 5×10^{11} 150°C 1×10^{9}	25°C 1.3×10^{14} 65°C 6.2×10^{13}	25°C 1.0×10^{14} 65°C 5.3×10^{13}			
Dielectric Strength (V/mil) 25°C	400-500	>330	>330			

1. *Shrinkage Test: ASTM D-551-41.*
2. *Hardness: Shore—D. Shore Instrument Co.*
3. *Specific Gravity—Federal Specification: LP-4068-5011 or 5012; 27 Sept. 1951.*
4. *Tensile Strength: ASTM D 638-52T*
5. *Thermal Conductivity: MIL-C-16923-A, Par. 4.6.10; 30 Oct. 1952.*
6. *Thermal Expansion: MIL-C-16923-A, Par. 4.6.9; 30 Oct. 1952.*
7. *Viscosity: Synchro-lectric Brookfield Viscometer, Brookfield Engrg. Co., Model R.V.F.*
8. *Stress Index: Westinghouse Materials Engrg. Physical Test Lab.Report by R. Phipps and J. Lesnick.*
9. *Dielectric Constant Power Factor Volume Resistivity: Rev. SC Instr. 27. 413-414 (1956).*
10. *Dielectric Strength: ASTM D-149-55T.*

the other low-density fillers, but that the silica powder has a bulk density at least twice that of the other low-density fillers. Although the temperatures resulting from the use of the low-density fillers are higher than that for the silica system, they are not excessive. From a further examination of table 3, it appeared that Kanamite would be the best filler to use from the standpoint of thermal conductivity.

Other Properties

However, to get a more thorough comparison between the various low-density filler systems with epoxy resin, a study of some of the physical and electrical properties of these systems was made. This data is presented in table 4. Since weight reduction is the primary goal of this work, it can be seen from table 4 that the phenolic microballons have the lowest bulk density, and hence give the greatest weight reduction. In addition, the stress index which was measured during thermal cycling between 10°C and −65°C, and between 10°C and +85°C is less than that for any other resin filler system measured.

Figure 5 shows the apparatus used to measure the stress index. The measuring device consists of a hollow stainless steel cylinder of .035-inch wall thickness. On the inside wall of this cylinder, two SR-4 strain gages are mounted, one circumferentially and one longitudinally. The outside diameter of the tubes is about 1 inch. This diameter was selected because it is representative of the size of the circuitry to be embedded. The procedure followed in embedding this measuring device is as follows. The measuring device is positioned in the center of a vinyl container. Resin is poured into the container, covering the device completely, and then lead wires from the SR-4 gages are connected to the measuring bridge. The stress in psi is measured and plotted against temperature over a temperature cycling range.

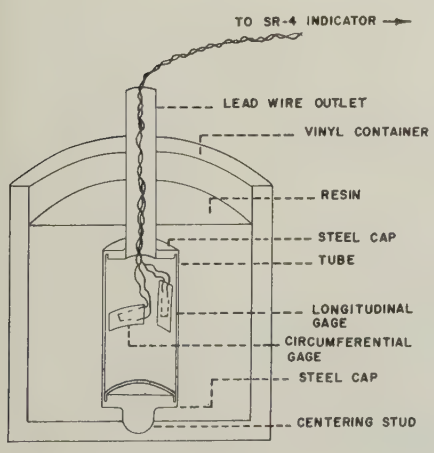

Figure 5, cutaway view showing tube potted in resin

A low stress index means less internal stress and less tendency toward cracking of embedded material. A high index indicates a greater chance of cracks developing. Further, a study of the curing cycle of the various resin filler systems has shown that the tendency for the phenolic microballoon filler to separate from the resin before gelling and to float to the top of the casting is less than for any of the other low-density fillers studied. This separation of filler would give a non-uniform density to the casting. This tendency to separate can be minimized by the addition of a thixotropic agent.

Further study of the phenolic microballoon-epoxy resin system—made to check thermal conductivity under actual operating conditions on a metal chassis—revealed that average hot-spot temperature of the embedded circuit at 23°C ambient was down from 105°C on the initial test to 83°C, and down from an initial temperature of 140°C to 103°C when operated at an ambient temperature of 85°C. This probably results from the fact that the metal base of the unit and the pins conduct some of the heat out of

Table 5. Environmental Tests and Results

Test	Cycle	Results
Thermal Shock	50 cycles, each cycle consisting of 2 hrs. at 85°C then immediately 2 hrs. at −65°C.	No electrical defects noted. All units performed satisfactorily.
Humidity	Mil-E-5272 95%-100% relative humidity for 10 days.	All pin to base insulation resistance readings were 100,000 (megohms) or more.
Vibration	Mil-E-5272 vibration was in each of the three axes with a lengthy time at the major resonant frequency.	All units operated satisfactorily.
Salt Spray	Mil-E-5272 50 hours exposure.	No effect detected.

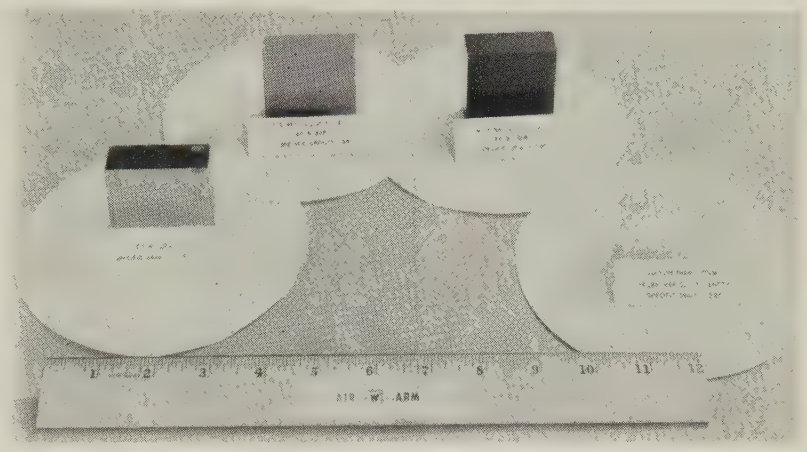

Figure 6, four blocks of resin and their specific gravities

the package to the metal chassis, which acts as a heat sink.

Environmental Tests

Further evaluation of the phenolic microballoon epoxy resin casting system was carried out as follows. A number of circuits similar to the one shown earlier were embedded in the selected formulation of 100 parts of Epon 828, 15 parts of BJOA - 0840 microballoons, and 10.5 parts of Shell curing agent D. These circuits were exposed to the environmental test listed in table 5 with the results as indicated. The results of these environmental tests indicate that the low density formulation based on Epon 828, phenolic microballoons, and curing agent D is equal to the Epon 828, silica 325 mesh, curing agent D formulation from the standpoint of environmental testing.

Figure 6 shows four blocks of resin. One is Epon 828 cured with Shell D, another is Epon 828 plus 325 mesh silica cured with Shell D, the third Epon 828 plus BJOA - 0840 cured with Shell D, and the last is a polyurethane foam of 14 pound density. You will notice the difference in specific gravity of the four resin compounds. The polyurethane foam block is included because polyurethane foam offers an even greater weight reduction than phenolic microballoon filled epoxy resin.

Figure 7 shows four identical circuits. One is unembedded, one is embedded in Epon 828 filled with silica, another is embedded in Epon 828 filled with phenolic microballoons, and the last is embedded in polyurethane foam.

Figure 8 shows four laboratory balances, weighing one of the four circuits shown in figure 7. You will notice that the unembedded circuit weighs 60.5g, the one in silica 167g, the one in microballoons 122g, and the one in foam 82.7g. You can calculate from these figures that there is a 27 percent saving in weight by using the microballoon filler in place of the silica, and a 51 percent reduction using foam.

One precaution which must be exercised when mixing the phenolic microballoons into the resin, both by

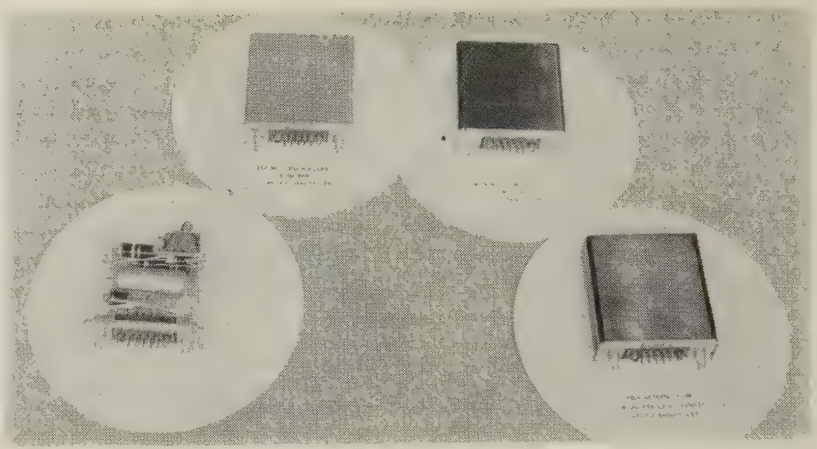

Figure 7, unembedded circuit, one embedded in silica filled Epon 828, one in microballoon filled Epon 828, and one in polyurethane foam

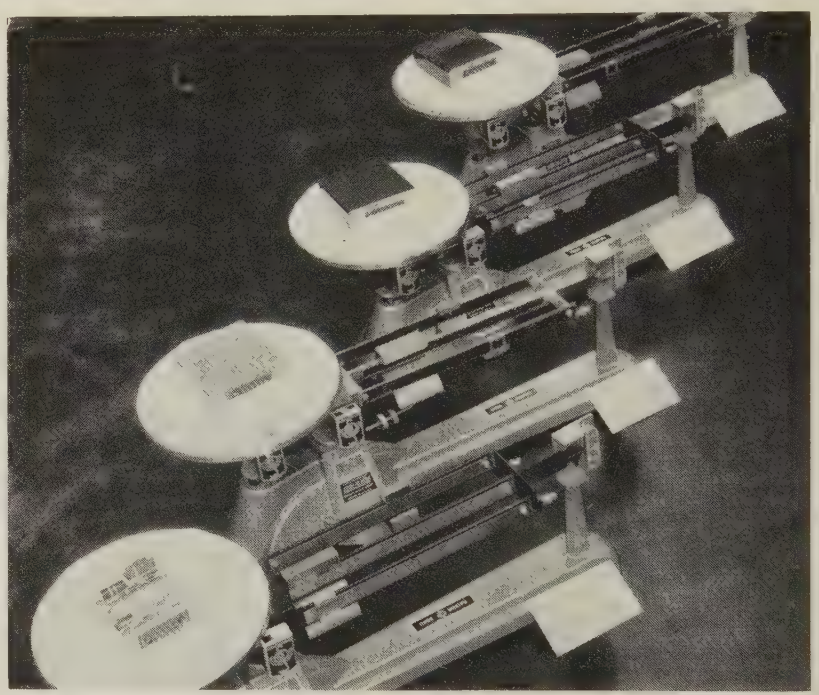

Figure 8, weight comparison of unembedded circuit to standard and low density embedding systems

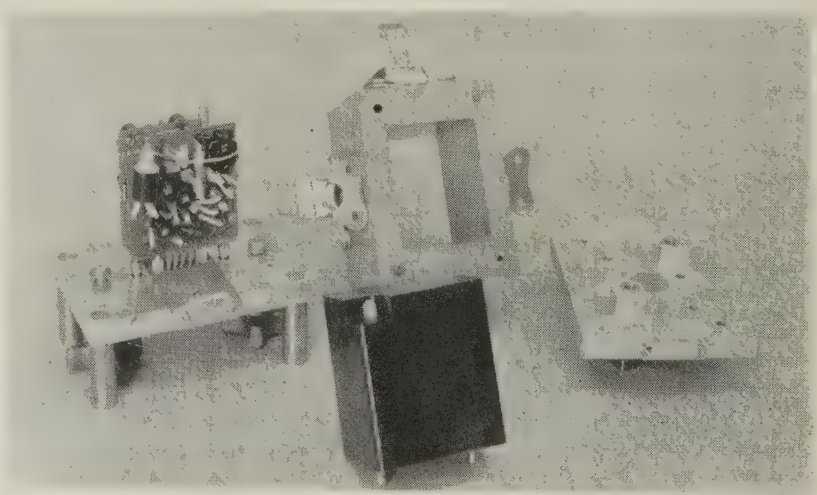

Figure 9, circuit, mold, and polyurethane embedded circuit.

hand mixing in the lab and by automatic mixing in the shop, is not to crush the spheroids. Excessive mixing time and beating action will crush the spheres and increase the bulk density of the mix, thus defeating the purpose of using the microballoons as weight-saving fillers.

Polyurethane Foam

Another way to reduce the weight of embedded electronic circuits is to embed them in polyurethane foam. Figure 9 shows a typical circuit, the mold in which it was foamed, and the foamed circuit itself. Of course, the foam has a much lower "K" factor than any of the low-density fillers, but it does bring about a 51 percent reduction in weight over the silica filled Epon 828, and a 32 percent reduction in weight over the microballoon filled Epon 828. However, its poor thermal conductivity precludes its use at the present time for embedding circuits where tubes and other heat generating components are present unless special heat sinks are designed into the package. It has found use in embedding transistorized circuits where there is very little heat generated.

Conclusion

In conclusion it can be said that phenolic microballoon filled epoxy resin can be used successfully in the following situations. It can be used to embed electronic units where the number of heat generating components included in the circuit are kept to a minimum. It can also be used in airborne embedding applications where weight saving is important because the bulk density of the filler is less than that of any of the other low-density fillers evaluated. It is also possible to embed circuits containing numerous heat generating components such as tubes and resistors in phenolic microballoon filled epoxy by designing heat sinks into the package.

Other advantages offered by the phenolic microballoon filler when formulated with Epon 828 and Shell curing agent D, are that the stress index is lower and that there is less tendency for this filler to float than for any of the other low-density fillers evaluated.

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A Study of the Thermoplastic Behavior of Enameled Magnet Wire

By Dipl.-Ing. F. Polenz, Electrical Testing Laboratory, Dr. Kurt Herberts & Co., Wuppertal-Barmen, Germany.

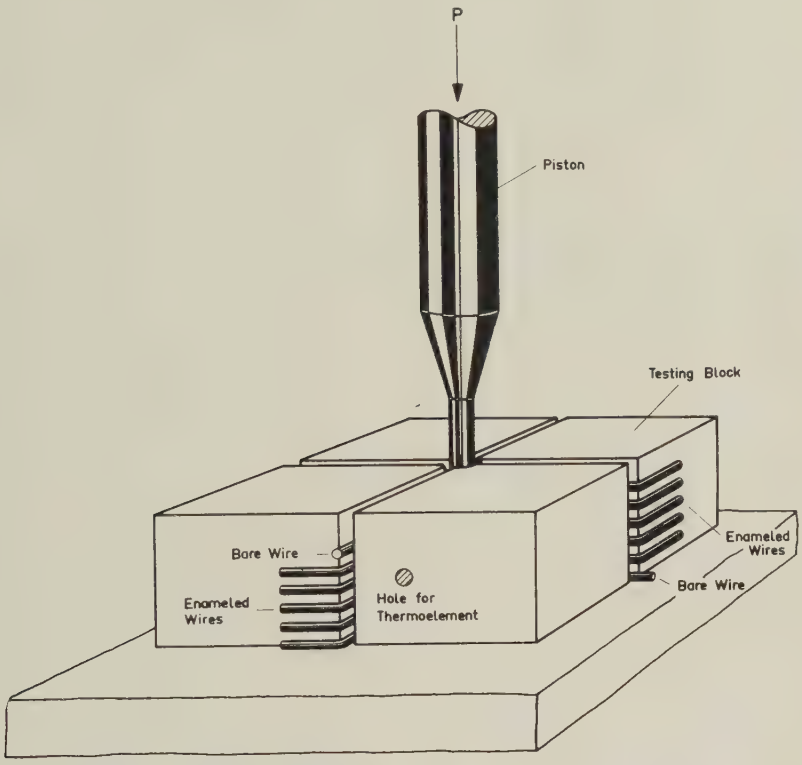


Figure 1, testing apparatus diagram.

In the rating of enameled magnet wire for windings in electrical machinery and appliances, resistance to high temperatures is an important factor since the operating temperatures of these windings are generally considerably higher than the room temperature (or the ambient temperature). Consideration must be given also to the fact that as the result of an overload, the temperature of the winding may rise for brief periods to levels considerably above the rated operating temperatures.

These thermal loads alter the characteristics of the wire's enamel film. Two distinct types of changes are recognizable:

(1) Changes in the chemical structure of the enamel film, the extent of the changes depending both on the level of the temperature and on the duration of its effect. These changes are referred to in technical parlance col-

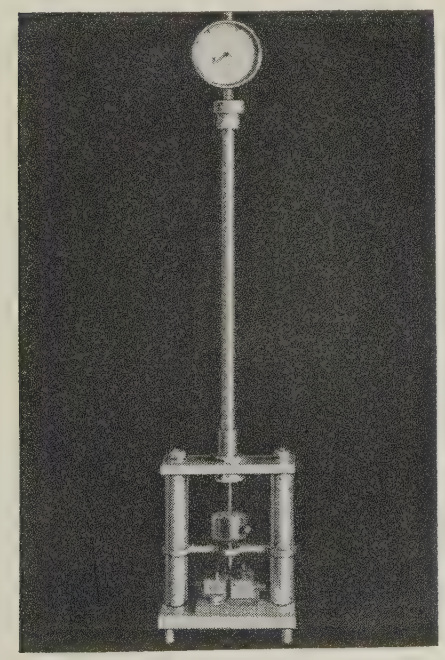


Figure 2A left, testing apparatus.

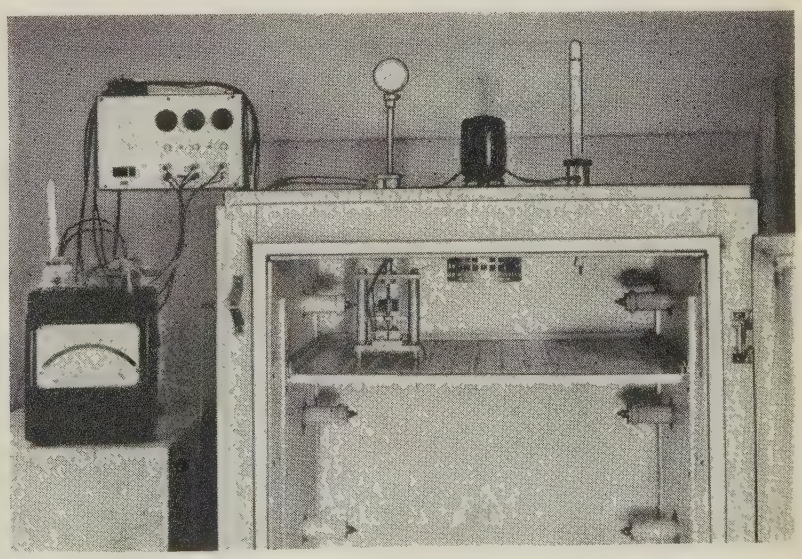


Figure 2B right, testing apparatus in the heating cabinet (the apparatus to measure the temperature is on the left).

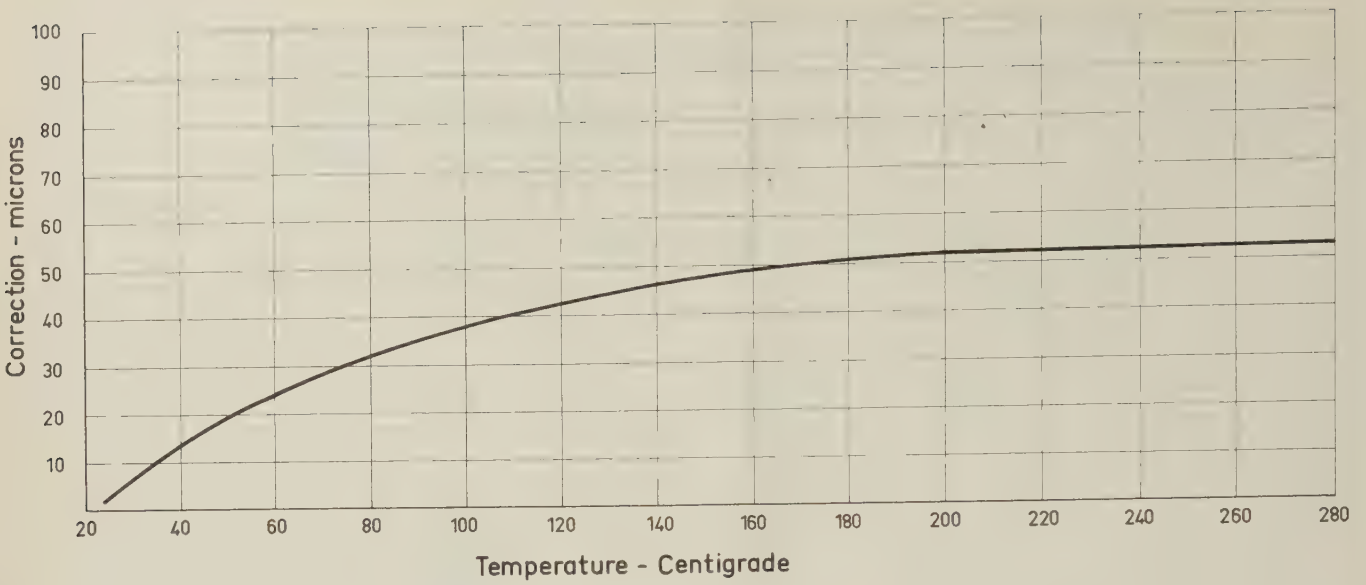


Figure 3, calibration of the testing apparatus.

lectively as "thermal alterations." They are not reversible changes, i.e., they are permanent changes in properties such as the reduction in the flexibility of the film or of its dielectric strength. This type of change also encompasses genuine losses of substances from the film which may be caused by the generation of volatile decomposition products or by the evaporation of portions of the film. (2) Reversible changes in the physical state of the enamel film which are influenced by, and dependent on, the temperature of the film. This type of change includes plasticity (softening by heat) and also reversible changes in the electrical properties, such as specific resistance, dielectric strength, or dissipation factor.

Thus, at a given temperature, the "chemical" changes indicated above under (1) are functions of the time, while the "physical" changes referred to above under (2) show a constant magnitude, unaffected by time. In practical operation, i.e., when the enameled wire is subjected to the effect of the temperature for an extended length of time, the preceding two phenomena have a mutually additive effect, in that on the constant magnitude of the physical change in properties there is superimposed a time-contingent magnitude of the corresponding chemical change. By utilizing a comparative evaluation of a series of observations to separate the two phenomena from each other, valuable information can be obtained on the suitability of different types of enameled wire for certain practical applications.

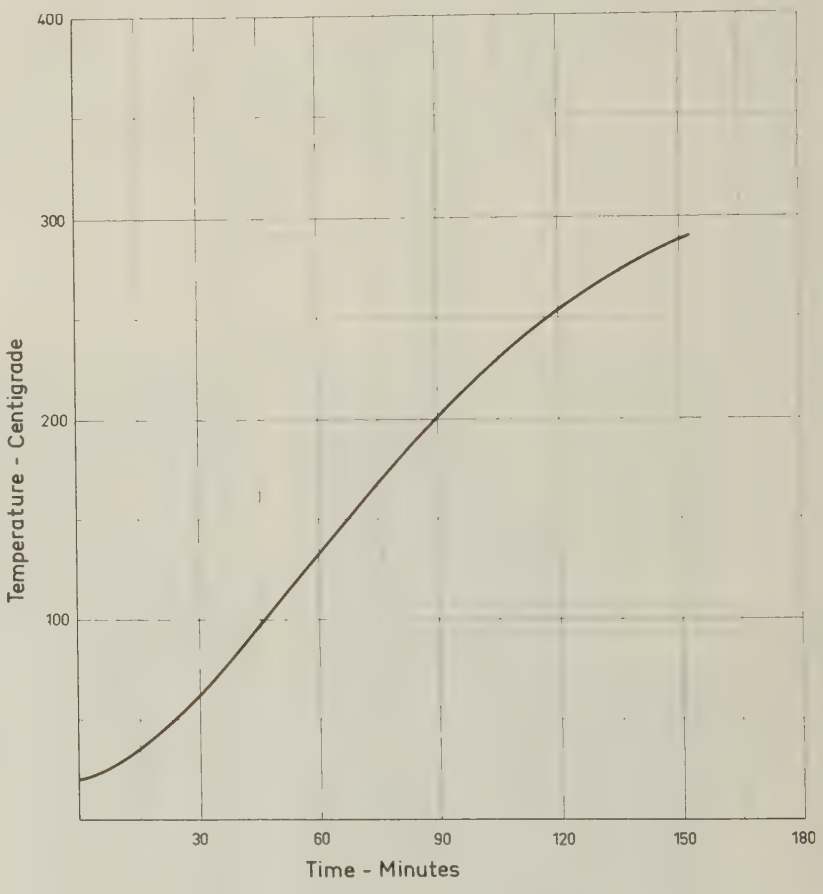


Figure 4, temperature of the test pieces as a function of the period of heating.

In the designing of electric motors, the thermoplasticity of the enamel film on the surface of the wires is an important consideration. The greater the tendency of the film to plasticity as a result of the rise in the tempera-

ture of the winding, the greater the danger of a short-circuit of the winding. The short-circuit is produced because the distance between the conductors (which is maintained by the enamel insulation), may be reduced by the mutual pressure of the windings of the wire until adjacent windings eventually come into contact with each other. In general, however, the distance between conductors does not shrink to zero. There usually is a "residual distance" which remains and which depends on the prevailing conditions of temperature and time. The magnitude of this "residual distance" can be regarded as a measure of the magnitude of the still existing operational safety of the winding.

The testing apparatus described below provides the means to study the thermoplastic behavior of enameled wires through the determination of this "residual distance" (figures 1 and 2A, 2B).

A testing block is used into which two mutually perpendicular, adjustable slits have been cut so as to form a cross. Ten carefully straightened samples of enameled wire are placed into these two slits, on top of each other, alternately, so that they cross each other and their crossing points are positioned over each other in the center. An easily movable piston is used to apply pressure at the point where the wires cross each other. This pressure can be regulated by using supplementary weights. The vertical travel of the piston is indicated by a precision dial gauge graduated in units of 1/1000 mm. A hole is bored in the testing block, into which a thermoelement can be inserted to measure the temperature. The entire testing apparatus is housed in a heated cabinet, in which appropriate controls permit the temperature to be kept at constant magnitudes ranging to approximately 300°C.

Since the length of the testing device itself undergoes a change as its temperature rises, the device must be pre-calibrated. This is done by using pieces of bare wire of the same nominal diameter as the samples of enameled wire (figure 3).

Dr. Kurt Herberts | RESIDUAL DISTANCE as a Function of the Temperature | ELECTRICAL TESTING LABORATORY

Mean Temperature Gradient °C/h | Type of Varnish

Load g | Diameter of Wire mm (No AWG)

Test No | Date

Temperature °C	Clock Time	Way Indication micron	Calibration micron	Reduction of Thickness micron	Total Coating micron	Residual Distance micron	Residual Distance %

Figure 5, printed form for recording data.

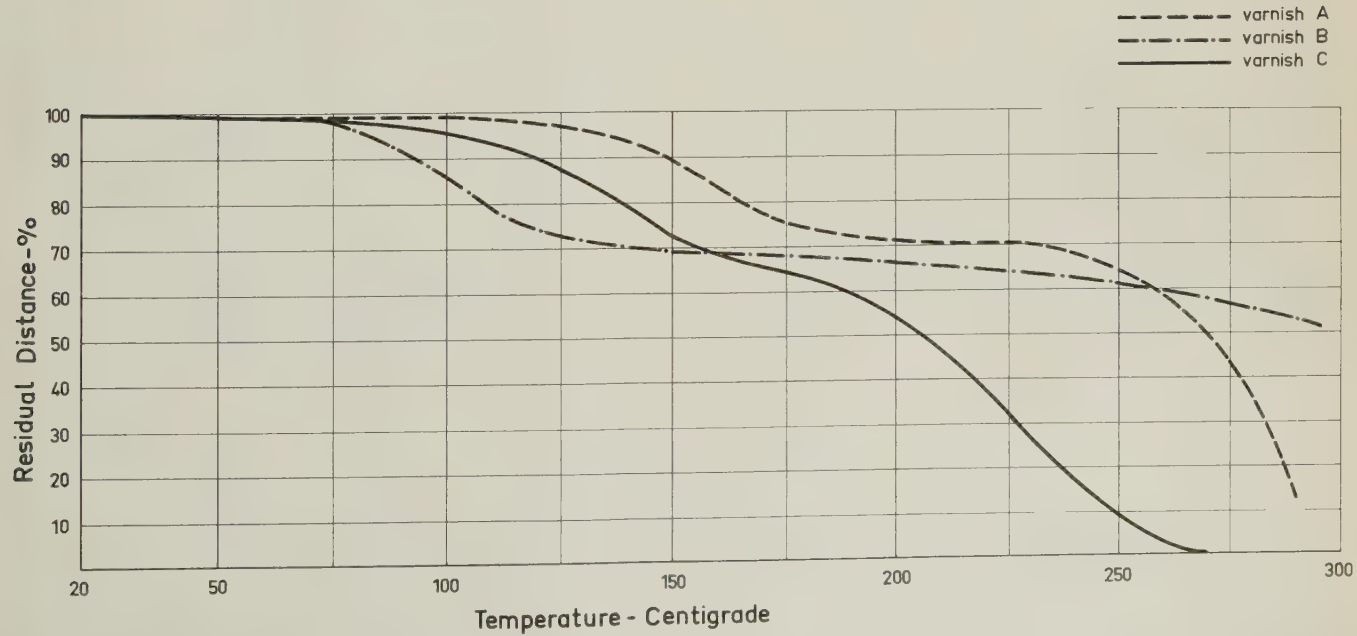


Figure 6, residual distance as a function of the temperature.

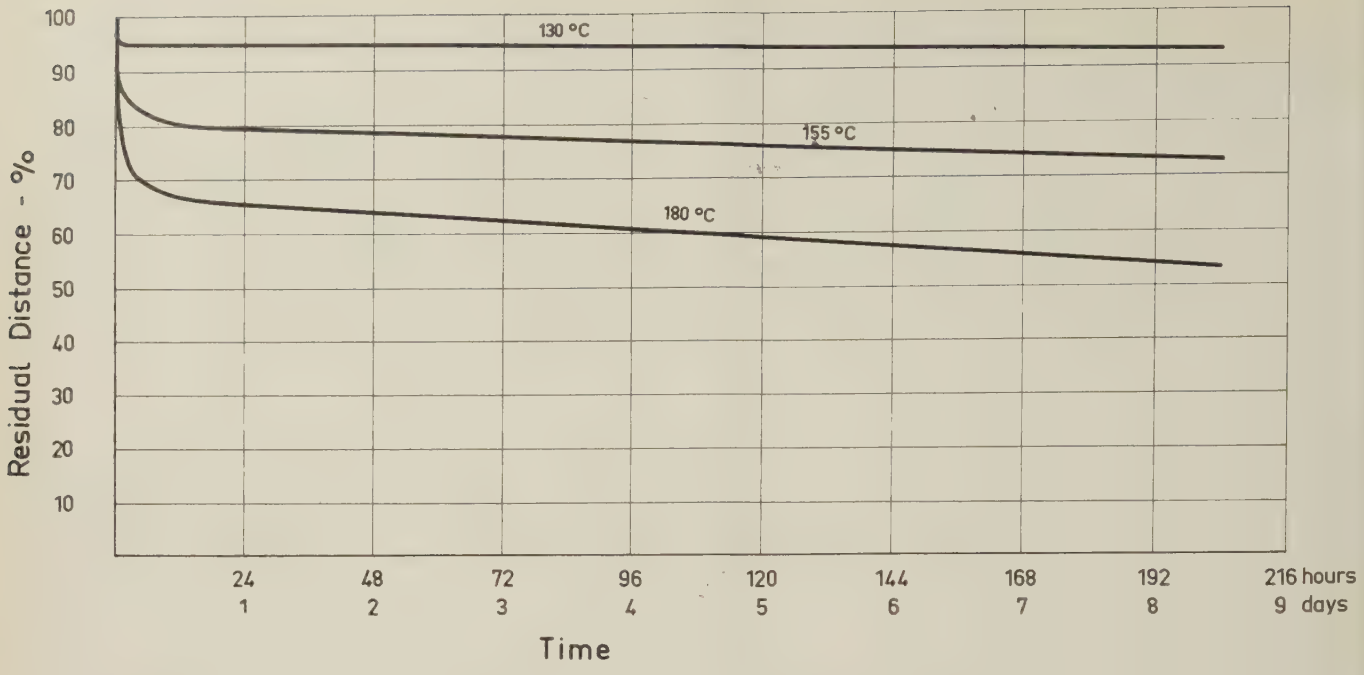


Figure 7, residual distance as a function of time at different t emperatures, varnish A.

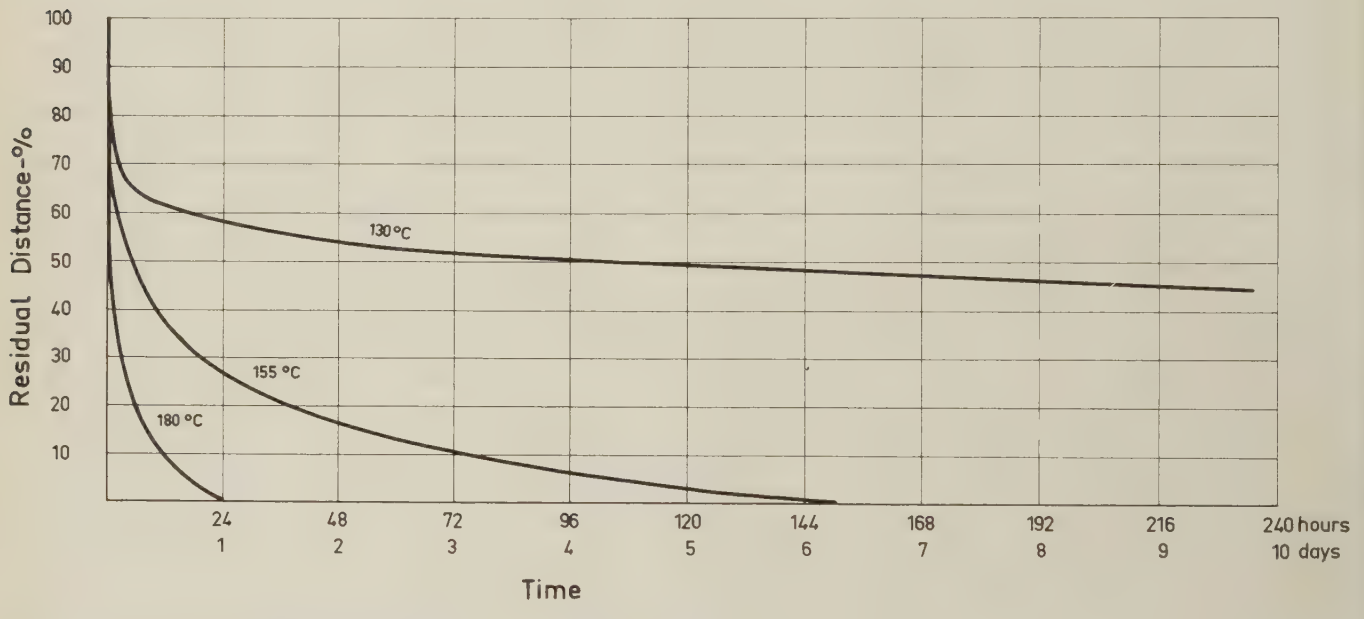


Figure 8, residual distance as a function of time at different temperatures, varnish C.

The study begins with the determination of the total thickness (D_o) of the enamel layers positioned under the piston. In order to determine this measurement as accurately as possible, a short piece at the end of each sample of enameled wire is bent at right angles and the overall diameters of the 10 wire samples are determined perpendicularly to the plane defined in this manner. The tenfold multiple of the diameter of the bare wire, also obtained by measuring, is deducted from the total for the enameled wire and the difference equals the total thickness, D_o, of the enamel layers.

In the next step, a piece of bare wire having a nominal diameter equal to that of the enameled wire is placed into the cross formed by the slits cut into the testing block. Then, the 10 samples of enameled wire are inserted, always alternating at 90° to each other. With the aid of the bent ends they are turned so as to occupy the same position as during the measurement of the thickness, so that the measurement planes are parallel to each other and perpendicular to the axis of the piston. The stack of wires is topped by another piece of bare wire which lies crosswise to the uppermost piece of enameled wire. Finally, the piston with the dial gauge is put on, and the test pressure which corresponds to the nominal diameter of the enameled wire is produced by adding supplementary weights. This pressure load can be seen in table 1. The

weights indicated are selected so that the mean specific pressure load of the enamel film reaches about the same magnitude for all nominal diameters.

The test is begun at room temperature. As soon as the starting position of the dial gauge has been read and recorded, the heating system in the heating cabinet is turned on so that the temperature of the cabinet will rise to the desired level. Figure 4 shows the rise in temperature, measured with the thermoelement, at the measuring point of the test apparatus. This temperature is nearly the same as that of the test pieces (observation of the air temperature in the cabinet is of no significance for the test). The distance traveled by the piston since the start of the test, as a function of the temperature, is read on the dial gauge and is recorded on the form shown in figure 5. By correcting these measurements with those taken from the calibration curve of the apparatus, we determine the total thickness D_t of the enamel layers which still actually remain at any given moment. This total thickness D_t is correlated with the original thickness D_o determined at the start of the study, and their ratio is the "residual distance" expressed as a percentage:

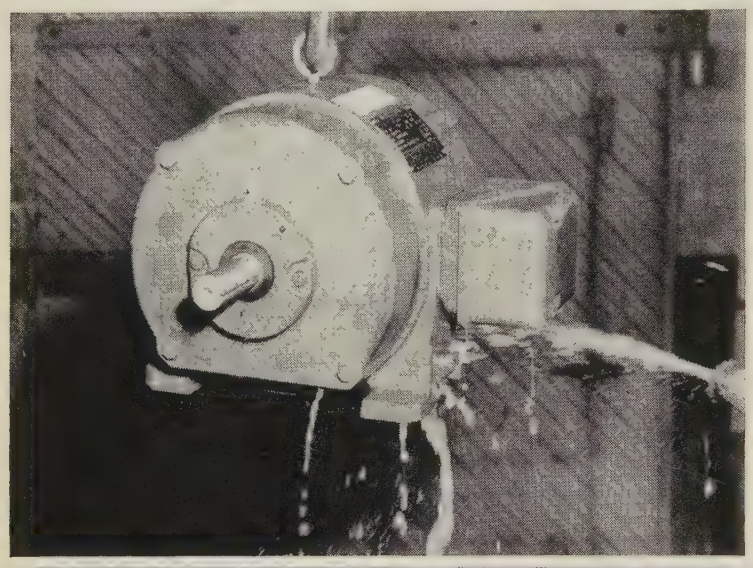
$$r = \frac{D_t}{D_o} \times 100\%$$

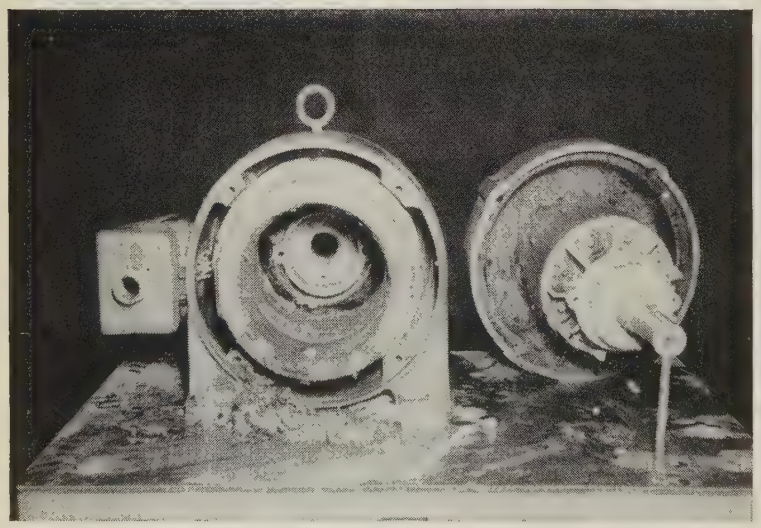
By plotting the magnitudes of the "residual distance," r, against the temperature, we obtain a curve that illustrates the behavior of the layer of enamel film as its temperature rises. Figure 6 shows the curves of "residual distance" obtained for three different types of enameled wire.

The investigation described can be expanded by extending the observation to continue over a longer period of time, with the temperature of the test pieces first raised rapidly to a terminal magnitude and then held constant at that value (figure 4). If such studies are carried out with different terminal magnitudes of temperature, we obtain families of curves (figures 7 and 8) from which conclusions can be drawn concerning the behavior of windings of enameled wire as regards the "residual distance" at long time thermal load. The different behavior of various types of enameled wire in the test described appears to be suited, in connection with other studies, to the determination of appropriate limiting temperatures for enameled magnet wires, thus facilitating their thermal classification.

Table 1

AWG	Load, g
26	110
25	140
24	170
23	200
22	230
21	280
20	310
19	370
18	400
17	500
16	600
15	700





The pictures above show the tests which Allis-Chalmers motors have passed. The first shows a motor as it was submerged in agitated muddy water for a full day. It was then hosed out, regreased, connected and rerun; (middle photo). Bottom photo shows a second motor taken apart to reveal the large quantity of mud that accumulated inside. Despite this, it was still in running condition.

BAKELITE BRAND Epoxies Help Motors Run Even After A Mud Bath

or -50° F cold, or salt water

People test electric motors in strange ways—submerge them in mud, run them in salt water, and freeze them in dry ice. Motors with coils encapsulated in epoxy resins have consistently withstood these tests and others; the pictures at left show one example.

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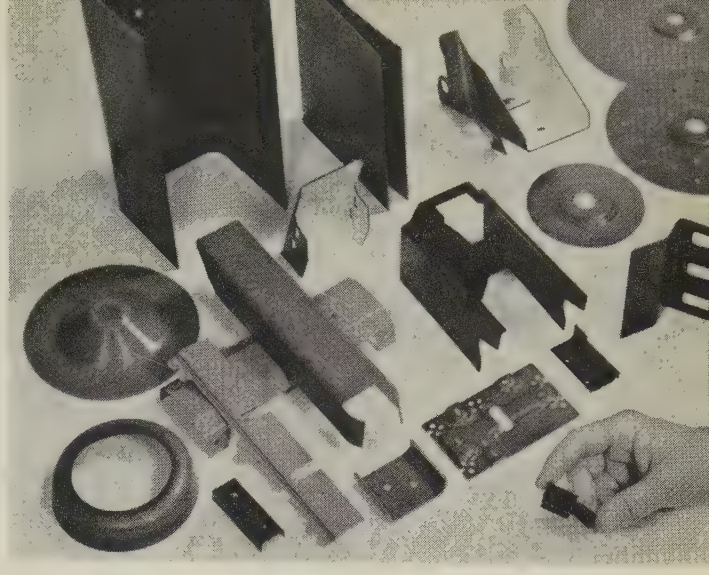
"Epoxylite" compound based on BAKELITE Brand epoxy resins, encapsulates the mud-bathed motor here. Success with epoxy compounds begins with success in epoxy resins. BAKELITE Brand epoxy resins are successful because the people of Union Carbide have learned so much about what they can do and how they should be used. To share in this wealth of experience, write Dept. AU-75, 30 East 42nd Street, New York 17, N. Y. *In Canada*, Union Carbide Canada Limited, Toronto 7.

◀ *Electric motors made by Allis-Chalmers Corporation have coils embedded in "Epoxylite" compounds formulated by Epoxylite Corporation, El Monte, Calif., based on BAKELITE Brand epoxy resins.*

Insulating printed circuits is another of the important jobs performed by BAKELITE Brand epoxy resins. Strong, impact-resistant, and able to withstand high temperatures, epoxies provide a big boost in performance.

Postforming for Low Cost Fabrication of Laminated Plastic Parts



By W. R. Gregg,
Product and Equipment Design Supervisor,
Continental-Diamond Fibre Corp., Newark, Del.

The postforming process for laminated plastics offers both design and production advantages. Plastic laminates in general lend themselves to applications where high strength-weight ratios, good electrical properties, and resistance to abrasion, weathering, moisture, and corrosion are required. Where laminates are used to meet such requirements and in addition can be postformed, production economies may also be realized.

For specific applications, postforming may offer the following advantages when compared with molded plastics.

1. Generally less expensive dies and tools. Frequently dies can be constructed of wood or plastics rather than of tool steel.
2. Less expensive retooling to meet new specifications.
3. Adaptability of dies. Frequently interchangeable dies can be used for several sizes or thicknesses of material. In addition, piercing or punching operations can often be combined with postforming.
4. Reduced labor costs.

Postforming laminates have been used in a variety of insulation and other applications such as ribbed panels, fan blades, ventilating ducts, phase barriers, guard plates, and tank liners for weak acids. About 85% of the parts made by the postforming process are for electrical uses.

In nontechnical terms, postforming can be defined as the technique of shaping, drawing, or forming thermosetting plastic laminates by heating them, forming them to new shapes, and then allowing them to cool while retaining these new shapes. It should be emphasized that the postforming operation is not a part of the manufacturing process used in producing the laminate, but is rather a forming method utilizing "C-stage" laminates.

Tooling for postforming can be made from such materials as wood, plastic, or steel and metal alloys with pressure applied by screw clamps, arbor or air operated or hydraulic presses. The amount of pressure used will depend on the complexity of the part, although it is generally in the area of 50 to 100 psi.

The laminate is first heated until

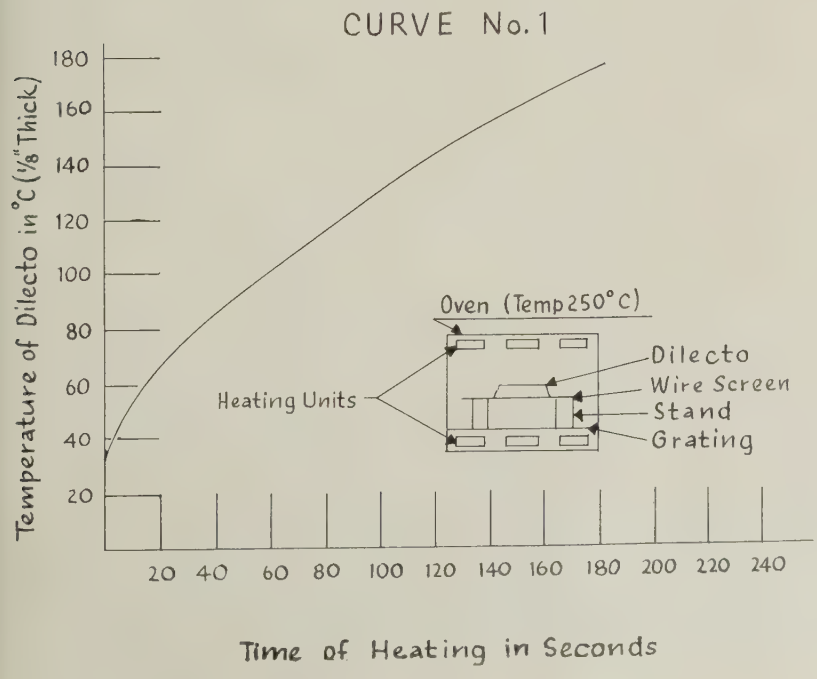


Table 1. Thickness Tolerances for Dilecto Postforming Grades

Nom. Thick., Inches	Tolerance, ±Inches	
	Grade CF-1	Grade XF
1/32	0.0065	0.005
3/64	0.0075	0.0065
1/16	0.0075	0.0075
3/32	0.009	0.009
1/8	0.010	0.012
5/32	0.011	0.014
3/16	0.0125	0.015
7/32	0.014	0.017
1/4	0.030*	0.018
5/16	0.035*	
3/8	0.040*	

**Plus only.*

pliable, either by infrared lamps, electric ovens with circulating air, electric strip heaters or hot plates, or by immersion in molten alloys or hot oil.

When the heated laminate has become pliable, it is formed by placing it quickly into a mold and subjecting it to pressure until it cools enough to retain the shape desired. In specific operations, some heat may be applied directly to the mold but normally molds are unheated except by the retained heat from the pieces being formed. It is important that the laminate be heated uniformly from both sides and that the temperature be neither too high nor too low. The approximate forming temperature for two CDF postforming grades is from

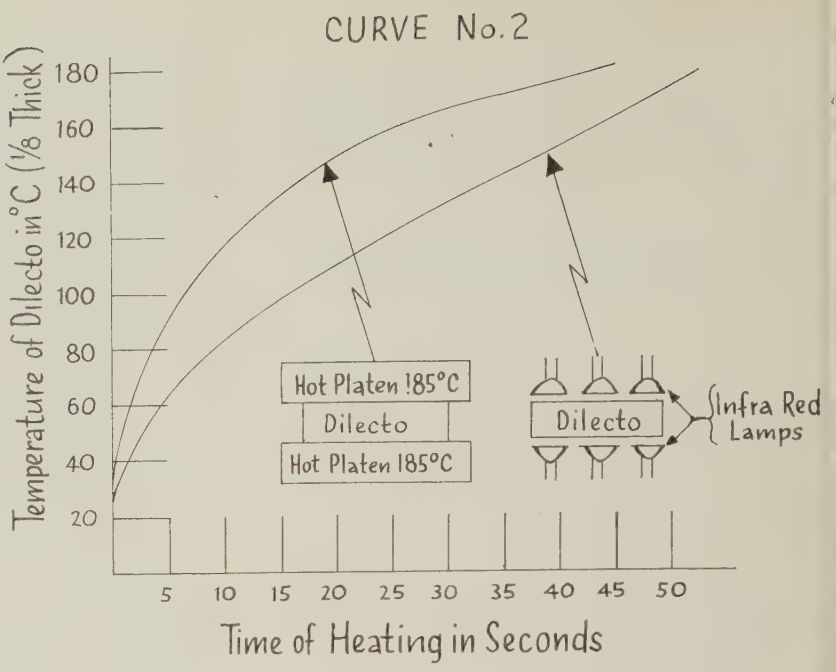


Table 2, Typical Properties and Available Sizes Of Dilecto CF-1 Fabric Base Postforming Grade

Properties (LW—lengthwise; CW—crosswise)	Thick., Inches	Condi-tioning	Typical Value
Tensile Strength, psi, LW or CW	1/32 to 1/2	A	10,000
Modulus of Elasticity in Tension, LW or CW	1/32 to 1/2	A	800,000
Flexural Strength, psi, LW	1/32 to 1/2 incl.	A	18,000
CW	1/32 to 1/2 incl.	A	17,000
Modulus of Elasticity in Flexural, LW or CW	1/32 to 1/2 incl.	A	600,000
Compressive Strength, psi	1/32 to 1/2 incl.	A	30,000
Shearing Strength, psi, (flatwise or edgewise)	1/32 to 1/2 incl.	A	12,000
Izod Impact Strength, ft. lbs/in. of notch, edgewise, LW	1/32 to 1/2 incl.	E-48/50	2.2
CW	1/32 to 1/2 incl.	E-48/50	2.0
Density (Sp. Gr.)	1/32 to 1/2 incl.	A	1.36
Rockwell Hardness	1/8 to 1/2 incl.	A	M100
After-Glow, secs, max.	1/32 to 1/2 incl.	A	4
Dielectric Strength, 60 cycles	1/32 to 1/2 incl.	E-168/107	15
Short Time, perpendicular to lam., vpm	1/16	A	500
	1/8	A	500
Step by step, parallel to lam., kv	1/16 to 1/4 incl.	A	8.0
Dissipation Factor, 60 cycles	1/16 to 1/2 incl.	A	0.25
	1/8	D-24/23	0.50+
Water absorption, %	1/16	D-24/23	2.5
	1/8	D-24/23	0.80
	1/4	D-24/23	0.55

All tests following ASTM or other test methods noted.

Conditioning nomenclature:

Cond. A—Tested in the "as received" condition under prevailing laboratory atmospheric conditions.

Cond. E-48/50—Conditioned 48 hours in oven at 50°C and
D-24/23—Conditioned 24 hours in water at 23°C

Cond. E-168/107—Conditioned 168 hours in oven at 107°C

Sizes:—Thickness Range—1/32″ to ¼″ incl. (Thicknesses up to ½″ are available for applications involving limited postforming operations.)

Sheet sizes—38″ x 38″, 38″ x 42″, 39″ x 46″, 39″ x 70″, 46″ x 70″, 48″ x 48″, 38″ x 42″, and 38″ x 96″.

Table 3, Typical Properties and Available Sizes Of Dilecto XF Paper Base Postforming Grade

Properties (LW—lengthwise; CW—crosswise)	Thick., Inches	Conditioning	Typical Value
Tensile Strength, psi, LW	.025 to 1/4 incl.	A	8,500
CW	.025 to 1/4 incl.	A	7,500
Modulus of Elasticity in Tension, psi			
LW	.025 to 1/4 incl.	A	1,100,000
CW	.025 to 1/4 incl.	A	1,000,000
Flexural Strength, psi, LW	.025 to 1/4 incl.	A	12,700
CW	.025 to 1/4 incl.	A	12,400
Compressive Strength, psi, flatwise	.025 to 1/4 incl.	A	32,000
Impact Strength, ft. lbs/in. of notch, edgewise, LW	.025 to 1/4 incl.	E-48/50	0.85
CW	.025 to 1/4 incl.	E-48/50	0.80
Water Absorption, %	1/32	E-1/105 plus D-24/23	5.0
	3/64		4.0
	1/16		2.4
	3/32		2.0
	1/8		1.6
	1/4		0.75
Density (Sp. Gr.)	.025 to 1/4 incl.	A	1.38
Rockwell Hardness	1/16 to 1/4 incl.	A	M105
Disspation Factor, 60 cycles	.025 to 1/4 incl.	A	0.15
	1/8	D-24/23	0.20
Dielectric Constant, 60 cycles	.025 to 1/4 incl.	A	7.5
	1/8	D-24/33	9.0
Loss Factor, 60 cycles	.025 to 1/4 incl.	A	1.1
	1/8	D-24/23	1.8
Dissipation Factor, 10^6 cycles	.025 to 1/4 incl.	A	0.032
	1/8	D-24/23	0.036
Dielectric Constant, 10^6 cycles	.025 to 1/4 incl.	A	4.50
	1/8	D-24/23	4.75
Loss Factor, 10^6 cycles	.025 to 1/4 incl.	A	0.15
	1/8	D-24/23	0.17
Insulation Resistance, megohms	.025 to 1/4 incl.	C-96/35/90	100
Arc Resistance, seconds	.025 to 1/4 incl.	A	10

Conditioning nomenclature:

Cond. A—Tested in the "as received" condition under prevailing laboratory atmospheric conditions.

Cond. D-24/23—Conditioned 24 hours in water at 23°C.

Cond. E-1/105—Conditioned 1 hour in oven at 105°C.

Cond. E-48/50—Conditioned 48 hours in oven at 50°C.

Cond. C-96/35/90—Conditioned 96 hours at 35°C and 90% relative humidity.

Sizes:—Thickness range 0.025″ to 1/4″ incl. (Thicknesses up to ½″ are available for applications involving limited postforming operations.) Sheet sizes—38″ x 38″ and 38″ x 42″, 39″ x 46″, 39″ x 70″.

145°C to 175°C and the time required to reach this temperature is dependent upon the heating medium and the thickness of the material.

Curves Number 1 and Number 2 show a typical time vs. temperature relationship for a ⅛-inch thick material heated by different methods. The rate of heating for direct contact strip or platens and infrared lamps is reasonably rapid when compared with the rate of oven heating. Perhaps the most rapid and the most critical method of heating is immersion in molten alloys at 220°C to 230°C.

Curves Numbers 3, 4, and 5 show the time/thickness relationship of the postforming materials for different heating mediums. The time indicated for the different thicknesses is the length of heating required to reach the forming state.

It is essential that the laminate be removed from the heating medium just as soon as the proper forming stage has been reached. It should then be immediately placed in the forming tool under pressure. If the laminate is allowed to remain in the heat-

ing medium after the proper forming stage has been reached, or if it is over-heated, there is considerable danger that the material may blister or become brittle.

Minimum bending radius (inside) and a list of typical maximum draw depths are shown in table 4. Where possible, draws should be circular, thus avoiding difficulties at corners of squares or rectangles. The maximum possible draw of the base fabric is along the bias of its warp and fill threads, and the pattern should be cut to take advantage of this characteristic.

Almost any laminate can be postformed provided it has reinforcement or base material which will extend during forming without tearing or mechanical damage. Fabric weave materials such as ducks, twills, and herringbone weaves, and single or double-filled duck cloths have served as reinforcement for laminates which have been postformed.

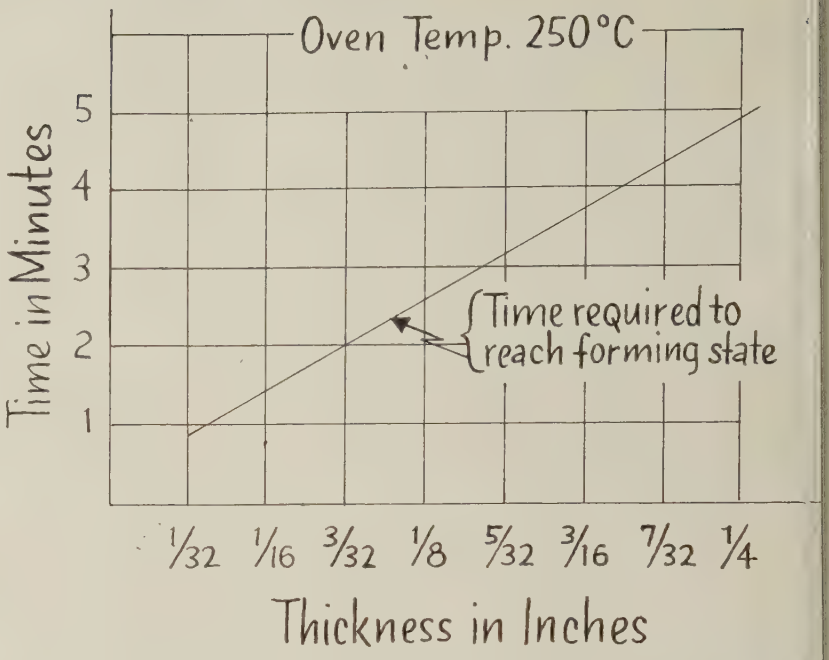
For bending processes, paper-based phenolic laminates are a less expensive material than the fabric-base grades, but are not as well suited for drawing operations because of their lower strength and ductility.

The NEMA thickness tolerances for postforming grades are shown in table 1, and properties and available sizes of typical fabric and paper-base grades are shown in tables 2 and 3. Recently, nylon fabric-base phenolics and glass-base "Teflon" grades have been used for postforming, primarily on an experimental basis.

Table 4, Min. Bending Radius (Inside) and Max. Depth of Draw

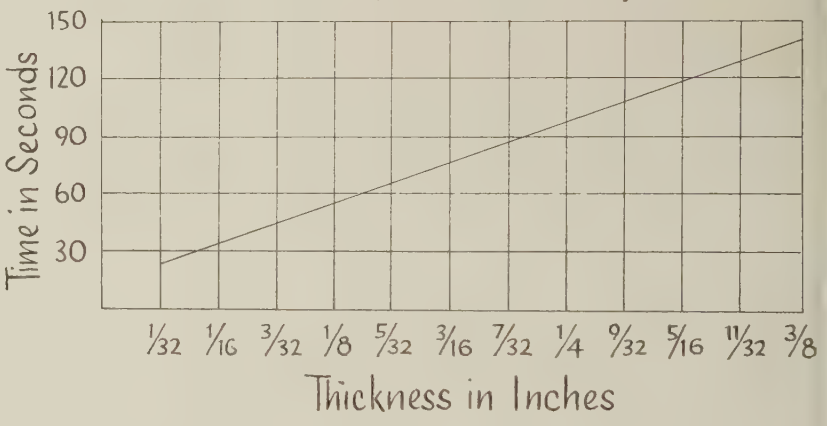
Nom. Thick., Inch	Forming Min. Inside Radius, Inch	Max Depth of Draw, for 3″ diam. Plunger, Inch
1/32	1/32	1-3/8
3/64	1/16	1-3/8
1/16	3/32	1-1/4
3/32	3/16	1-1/8
1/8	5/16	3/4
5/32	7/16	—
3/16	9/16	—
7/32	13/16	

CURVE No. 3



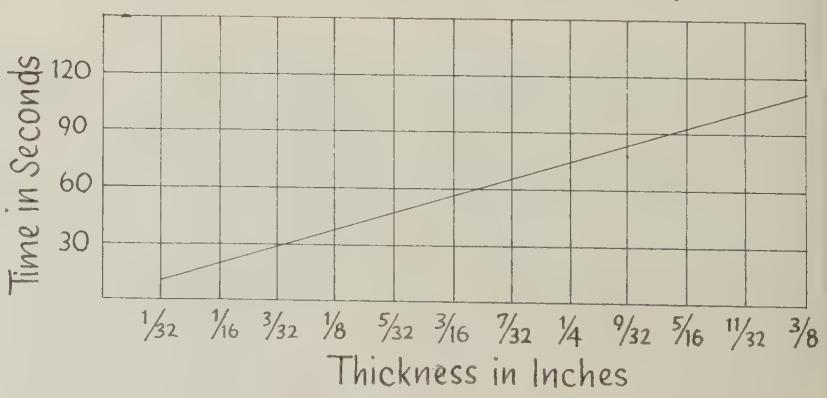
CURVE No. 4

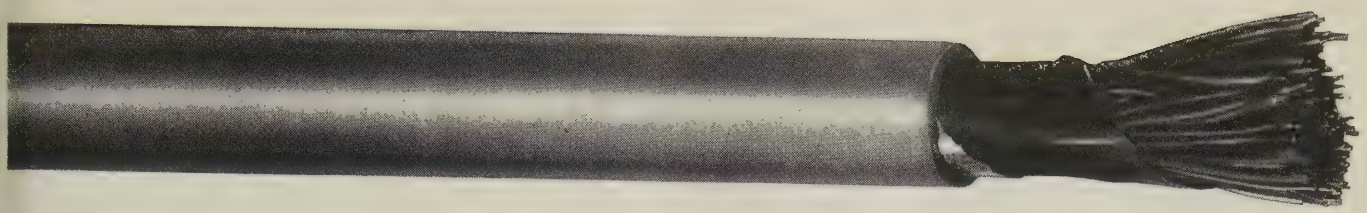
Time Required to Reach Forming State with Infra Red Heating



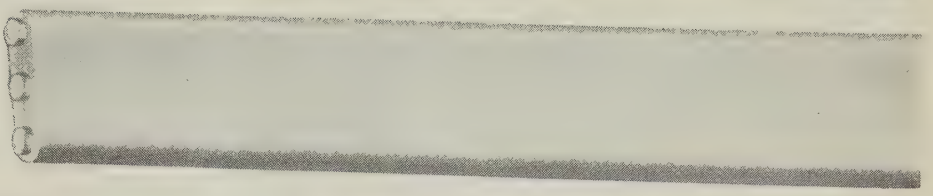
CURVE No. 5

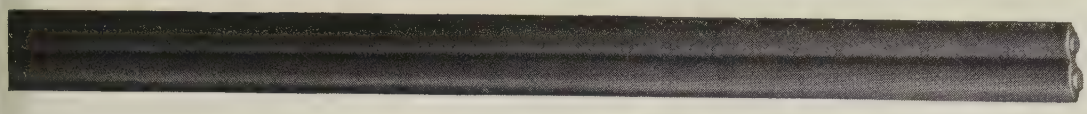
Time Required to Reach Forming State with Direct Contact Hot Platen. Temp. 185°C



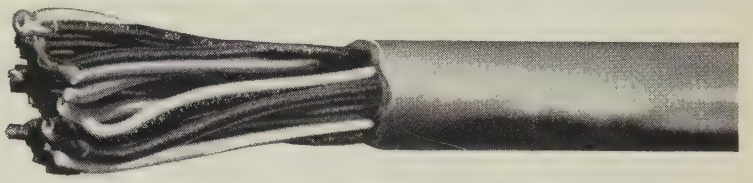


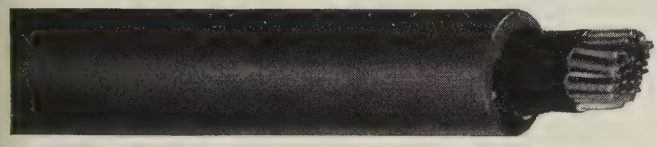
A VITAL PART



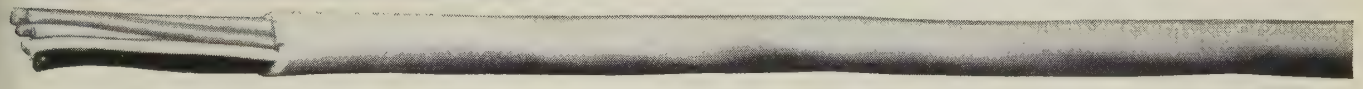


OF YOUR VINYL INSULATION...





THE RIGHT PLASTICIZER



The service life and performance of your vinyl insulation compound center around its plasticizer. In addition to providing good electrical properties, the Rohm & Haas plasticizers listed here impart exceptional resistance to plasticizer extraction by water, soapy water, and oil. They have very low volatility, and high resistance to migration into lacquers, baked enamels, rubber, and polystyrene. Furthermore, vinyls using these plasticizers show excellent retention of physical properties on exposure to high temperatures. Key uses for the individual grades include:

MONOPLEX S-90E—applications requiring retention of resistivity, tensile strength, and elongation after long-term high-temperature aging (either dry, immersed in water, or exposed to high humidity).

PARAPLEX G-54—standard appliance wire, including 105°C insulation; has particular merit wherever 1) retention of compatibility under high humidity exposure and 2) freedom from plasticizer migration into polystyrene, rubber, lacquers and other coatings are required.

PARAPLEX G-50—also for standard appliance wire, particularly when cost is an important factor.

PARAPLEX G-62—provides stabilization against heat; ideal for high-temperature insulation; also can be used in stabilizer quantities with general purpose plasticizers in lower-cost wire such as extension cords.

Get technical information on these and other Rohm & Haas plasticizers. Write for a copy of *What You Should Know about* PARAPLEX *and* MONOPLEX *Plasticizers.*

Chemicals for Industry

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THE RESINOUS PRODUCTS DIVISION

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Print Ins. 22 on Reader Service Card

Insulation Forum

This regular monthly feature is built around a timely question concerning the electrical insulation field. Your suggestions for future questions and participation are invited. This month's question is:

Please list and discuss the relative importance of job factors you consider important for attracting and retaining such highly skilled personnel as engineers and scientists.

R. Steward

Specification Engineer, Airpax Electronics Inc., Cambridge, Md.

"The factor I consider most important for attracting and retaining engineers and scientists is success. Prospective employees must be made to feel that their venture with the company will be successful. Employees must see it happen every day. Individual definitions of success vary. However, at a minimum, employees want to feel that they are doing a good job, and from this they know their other desires such as increased pay, promotion, and professional advancement will be forthcoming.

"Being able to do a good job requires, naturally, the right person to do it. Most important, though, it requires the right supervision, and this can be a very difficult problem—especially if the work happens to be in a field where the supervisor has had no training."

R. B. Gorski

President, Electronic Coil Corp., Plainville, Conn.

"It is a known fact that skilled personnel are the roots of the successful manufacturer. To maintain a successful balance, the roots must certainly be allowed to spread and strengthen the manufacturer's position in any highly competitive field of manufacturing.

"Leaders in industry are constantl on the alert for personnel with pra tical engineering and scientific bac grounds. This is especially true manufacturers of mass productio commodities. Manufacturing exec tives are pointing to human enginee ing as a new frontier yet to be e plored.

"To retain our skilled personne the following must be clearly unde stood. The contract, verbal or othe wise, which ties a man to his job mus be one in which good faith must hav the deepest significance. From the em ployer's standpoint, the work done i his business is the commodity he o fers to society. Faithful work is a mus for the success of his business—faith ful employees his greatest asset."

R. Oberrecht

Engineer, General Railway Signa Co., Rochester, N.Y.

"A recipe of job factors for scien

tists and engineers:

1) Large quantities of challenging jobs.

2) Add trained assistants seasoned with accurate and reliable equipment.

3) Sprinkle well with considered recognition.

4) Allow to simmer under pleasant working conditions.

5) While simmering, flavor with adequate financial remuneration.

6) Occasionally add a dash of this or that to suit individual tastes.

7) Keep simmering."

S. F. Trush

General Manager, Air-O-Tronics, Lancaster, Cal.

"Job factors I believe important to attracting engineers and scientists are:

1) Just compensation—Wage standards of the industry should be observed. Employer must be willing to pay for the calibre of help he desires.

2) Advancement potentials—Opportunity to advance should be clearly and conservatively stated.

3) Job appeal—Emphasize placement, working environments, privileges, facilities, etc.

4) Job security—Longevity of job. Future outlook of employer.

5) Retirement and emergency program—What plans are available, pension, profit sharing, stock options, life insurance, health, and accident, etc.

6) Employer's sincerity—Impart trust from initial contact.

"To retain:

1) Effectively utilize skills—Determine best niche. Avoid overmanning. Reduce or eliminate clerical type duties. Streamline report writing by using modern recording methods.

2) Provide the best possible job climate—Establish well planned and challenging work programs with concrete objectives. Encourage individual decisions. Delegate responsibility with authority. Provide opportunities to advance.

3) Provide necessary facilities—Adequate and proper equipment tools to perform the job assigned. Up-to-date technical library. Competent clerical help. Good working environment.

4) Recognize accomplishment—By personal contact. Meaningful compensation growth."

Pixilated Patents

By Mike Rivise

(Forty-second in a series of odd and interesting inventions in the electri-onics field from the files of the U.S. Patent Office.)

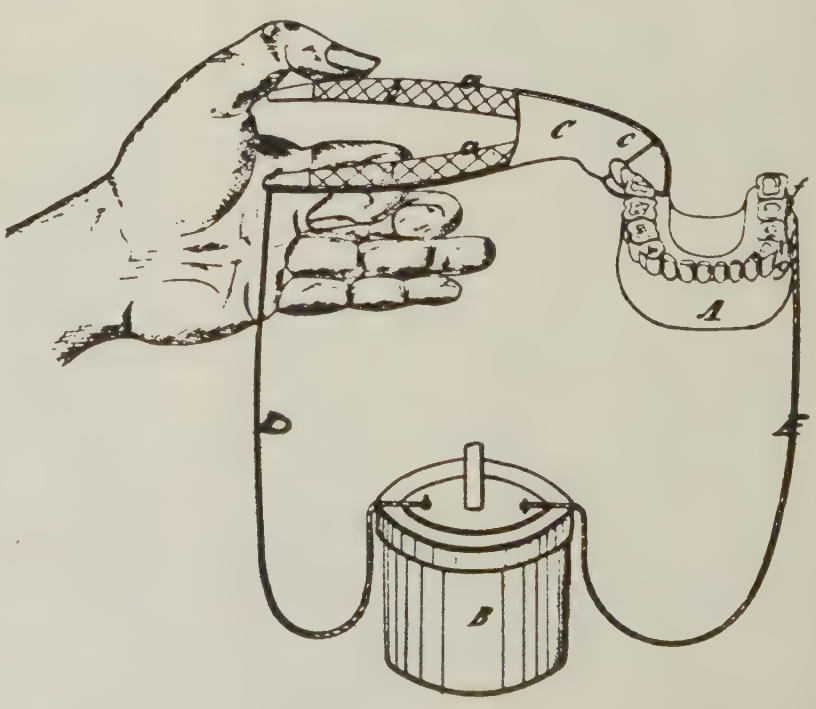
Ever since man's first toothache, sympathetic men have been searching for a way to alleviate such pains. The advent of electricity and the consequent extravagant claims made by many quacks regarding its curative powers for all sorts of human ailments naturally led to investigations of its possible use in dentistry. And as early as 1859, one would-be benefactor claimed that he could alleviate the pain of extracting teeth by continuous application of electrical current through the extracting forceps. As the philanthropic inventor, Nahum Washburn of Bridgewater, Mass., explained in the description of his patent No. 26,388, dated December 6, 1859, "In extracting a tooth the forceps or instrument may be arranged in the circuit so that the electric current may pass from such instrument and into the part operated on. In this way the surface or part against which the surgical instrument is made to act, or the part immediately surrounding the same, may be made to receive electricity and to be more or less benumbed, whereby the pain of the operation may be alleviated. I have discovered, and practically demonstrated by numerous experiments, that electricity applied under such circumstances may be employed to great advantage in preventing or alleviating pain, having extracted teeth with little or no suffering to the patients operated on.

"In the process of extracting a tooth I generally allow the forceps to remain on the tooth and the electricity to flow through it for a short period of time before attempting to draw the tooth, such being in order to render the nerve or nerves of the jaw and tooth sufficiently benumbed for the operation of extraction."

In the drawing, A denotes the jaw of a person, B is the galvanic battery or generator of electricity, C is a pair of extracting forceps having their handles *a a* covered with silk *b* a their joint covered with a tubu cover *c* of vulcanized India rubb and D and E are the circuit wi leading respectively from oppos poles of the battery. One of them fastened to the metal of the force and the other is attached to a sm button or knob *f* which is press against the gum *g* of the jaw. "In t way the electric current will be caus to flow through the tooth and nerves of sensation."

Washburn also appeared to demo strate a very commendable conce for his patients when he made a s cial point of indicating in the pat that "the portion of the instrum which is to be grasped by the opera should be insulated from the circu so as to prevent the electricity fr being directed from its proper cour For this purpose such part held in t hand may be covered with silk other suitable non-conductor of el tricity."

On the other hand—and we h to mention it—he may have been t ing to protect himself in the eve that he should have to demonstra use of the device.



NEW SPAULDITE XXXP-770

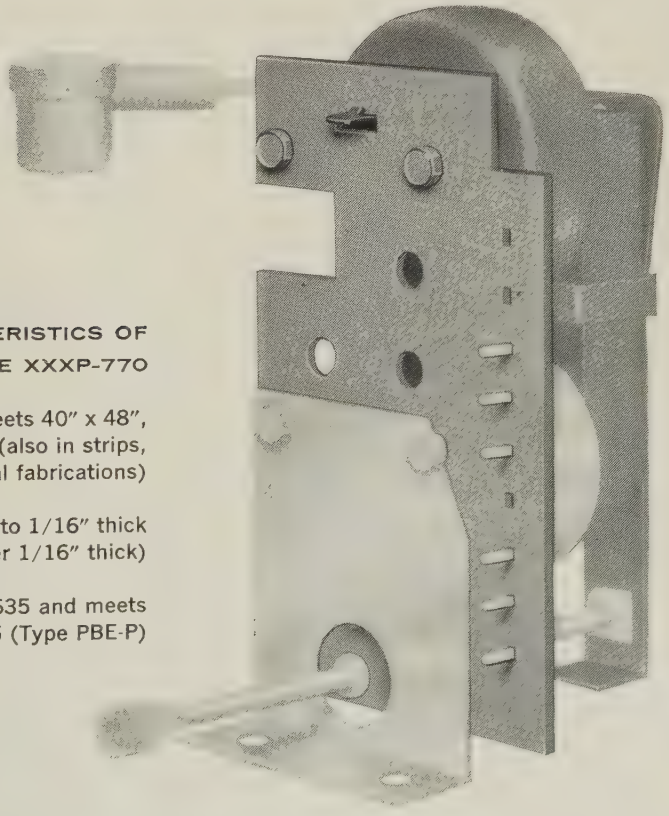
- COLD PUNCHING
- FLAME RETARDANT AND LESS EXPENSIVE THAN PAPER BASE EPOXIES

Another product of Spaulding research, new Spauldite Grade XXXP-770 makes simplified design of many electrical and electronic components a reality.

It is low in cost, self extinguishing, has good moisture resistance, can be cold punched and has high mechanical and electrical properties.

Shown here in a flyback transformer application for television receivers, XXXP-770 is especially suited for all uses in which fire is a hazard.

Contact Spaulding for more information on XXXP-770 or Progress Reports on other new Spaulding Applications for Industry.



CHARACTERISTICS OF SPAULDITE XXXP-770

Furnished in sheets 40" x 48", thicknesses 1/32"-3/16" (also in strips, blocks or special fabrications)

Cold punching up to 1/16" thick (Warm punching over 1/16" thick)

Flame Retardant — ASTM-D635 and meets UL requirements and MIL-P-3115 (Type PBE-P)

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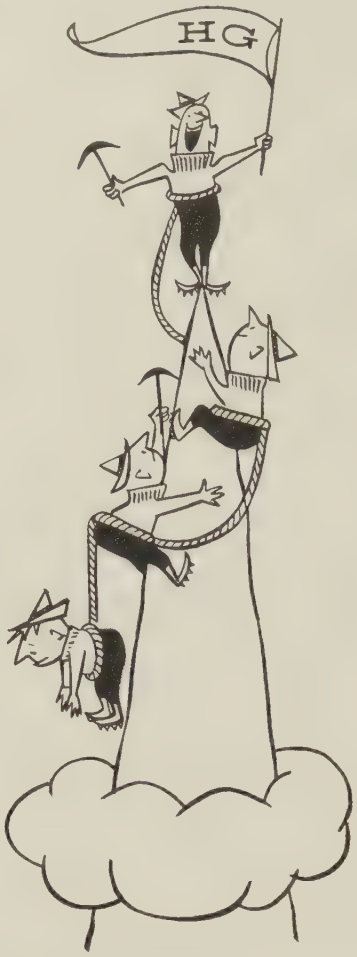

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Print Ins. 28 on Reader Service Card

Solidifying Fluid Survey Shows Processing Equipment Used, Applications, Attitudes

In last month's issue, *Insulation* described a reader survey which dealt with solidifying fluid insulations—those electrical insulation materials which are used or applied in a fluid form and which are subsequently converted to a solid, film, or foam form. More commonly, these materials would be called varnishes, enamels, resins, waxes, potting compounds, etc., but such terms were avoided in the survey to prevent prejudicing of the results.

A total of 2,994 individuals, each at different plants, received the survey questionnaire—893 were returned for a response of 29.83%. Of these, 787 or 88.13% were considered usable and of the 787, there were 589 or 74.8% of the respondents who indicated that their plants used solidifying fluid insulations. In the last issue of *Insulation*, some of the improvements desired in materials and in processing of materials as uncovered by the survey were described. In this issue, processing equipment possessed by users, applications, and attitudes toward suppliers are discussed.

Solidifying Fluid Processing Equipment

One of the questions in the survey asked solidifying fluid insulation users to indicate by means of check marks whether their plants had any of the following types of processing equipment: dipping tanks, vacuum impregnating equipment, infra red ovens, baking ovens, resin mixing and dispensing equipment, molding equipment, heated presses, or spray equipment. Table 1 shows the number of users (and percentages) who indicated that their plants possessed the various types of equipment for each product code group. The actual number of mentions for each type of equipment and percentages are also shown. As would be expected, nearly

Table 1—Processing Equipment Possessed by Solidifying Fluid Users

		Number of Mentions and Percentage per Product Code*													Actual Mentions		
Product Code* →		A	B	C	D	E	F	G	H	I	J	K	L	M	Actual Number	% of Users (589)	% of Usable Replies (564)
Total Users →		123	242	88	64	20	93	78	115	141	97	98	48	7			
Equipment ↓																	
Dipping tank	No. →	103	165	55	26	12	60	33	49	51	44	38	28	5	309	52.4	54.7
	%** →	83.8	68.2	62.5	40.6	60.0	64.6	42.3	42.6	36.2	45.3	38.1	58.3	71.5			
Vacuum impreg. equipment	No. →	56	176	50	31	4	45	49	78	82	62	49	20	3	319	54.2	56.5
	%** →	45.6	72.7	56.7	48.4	20.0	48.4	62.8	67.8	58.2	63.9	50.1	41.7	42.8			
Infra red oven	No. →	30	66	24	18	6	22	28	43	34	22	28	13	2	153	26.0	27.1
	%** →	24.4	27.2	27.2	28.1	30.0	23.7	35.9	37.4	24.1	22.7	28.6	27.1	28.6			
Baking oven	No. →	114	221	77	50	18	78	62	105	111	84	81	39	5	521	88.6	92.4
	%** →	92.7	91.3	87.4	78.1	90.0	83.9	79.5	91.3	78.7	86.7	82.7	81.3	71.5			
Resin mix. & dispens. equip.	No. →	27	82	37	31	2	29	28	45	46	36	28	9	1	178	30.2	31.5
	%** →	21.9	33.9	42.1	48.4	10.0	31.2	35.9	39.1	32.7	37.1	28.6	18.7	14.3			
Molding equipment	No. →	21	94	38	33	5	33	32	51	45	37	28	10	2	195	33.2	34.6
	%** →	17.1	38.8	43.2	51.6	25.0	35.5	41.0	44.3	31.9	38.2	28.6	20.8	28.6			
Heated press	No. →	24	46	26	19	2	16	24	32	35	31	19	8	1	118	20.0	20.9
	%** →	19.5	19.0	29.5	29.7	10.0	17.2	30.3	27.8	24.8	32.0	19.4	16.7	14.3			
Spray equipment	No. →	81	131	40	29	12	52	47	49	69	5	53	24	4	285	48.4	50.5
	%** →	65.8	54.1	45.4	45.3	60.0	55.9	60.2	42.6	48.9	5.2	54.1	50.1	57.2			
No answer	No. →	2	3	1	3	—	4	3	5	11	6	5	4	—	25	4.2	—
	%** →	1.6	1.2	1.1	4.7	—	4.3	3.8	4.3	7.8	6.2	5.1	8.3	—			

*A—Motors, generators, and parts (manufacturing or repair).
B—Transformers, coils and related devices and parts.
C—Insulated wire and cable.
D—Wiring devices, connectors, etc.
E—Household and commercial appliances.
F—Switchgear, controls, relays, circuit breakers, switches, parts, etc.
G—Printed circuits.
H—Electronic components and parts (tubes, capacitors, resistors, semi-conductors, etc.).
I—Electronic and communication apparatus and assemblies.
J—Aircraft and missile parts and equipment.
K—Instruments and test equipment.
L—Electrically or electronically controlled, operated, or powered tools and machines.
M—Other.
*Percent of number of users in particular product code group.

all users had dipping tanks or vacuum impregnating equipment and infra red ovens or baking ovens. The number of users with vacuum impregnating equipment and infra red ovens is probably higher than expected. The percentages for other types of equipment are also surprisingly high.

Applications for Solidifying Fluids

Users were asked to briefly describe important specific applications in their products for which solidifying fluid insulations were used. A total of 828 applications were listed by users. Naturally, in trying to classify such applications, much depends on definition and terminology. However, table 2 represents a rather broad attempt to indicate general types of applications.

Some of the specific cementing or bond applications mentioned include bonding of insulation to metal or other insulation materials, end-turn bonding, coil joint cementing, holding wires and parts in place, fastening metal terminal lamp bases to glass bulbs, attaching components, and holding coils in place as well as brackets, shields, and mechanical parts, etc.

Dipping, coating and finishing applications were mentioned for nearly all types of electrical and electronic components including terminal boards, capacitors, printed circuits, coils, controls, motors, panelboards, resistors, electrical steels, transformers, wire, etc.

Some of the items mentioned under casting and molding included amplifiers, small assemblies, slip ring bases, bushings, coils, connectors, mechanical parts, plugs, phenolic cards, resistors, transformers, and specialty items.

The largest group, potting, encapsulating, and embedding applications, included amplifiers, armatures, electronic assemblies, terminal boards, cable ends, splices, capacitors, circuits, coils, connectors, controls, delay lines, wiring devices, filters, harnesses, heating elements, instruments, wave tubes, magnetic heads, motors, networks, plugs, potentiometers, coup-

Table 2—Types of Insulation Applications for Solidifying Fluids

Applications	Number of Mentions
Cementing, binding, adhering, bonding	50
Dipping, coating, finishing, varnishing	98
Casting, molding	46
Potting, encapsulating, embedding	301
Impregnating, saturating, filling, sealing	204
Other	121
Users who did not answer question	46

*Table 3—Users' Opinion of Solidifying Fluid Manufacturers Number of Mentions and Percentage per Product Code**

Product Code	Opinion: Excellent No.	Excellent %**	Good No.	Good %**	Poor No.	Poor %**	Total Answering No.	Total Answering %**
A	33	28.0	79	66.9	6	5.1	118	100.0
B	41	17.8	181	78.7	8	3.5	230	100.0
C	12	14.5	61	73.5	10	12.0	83	100.0
D	8	13.8	45	77.6	5	8.6	58	100.0
E	1	6.7	12	80.0	2	13.3	15	100.0
F	18	22.2	61	75.3	2	2.5	81	100.0
G	13	19.1	53	78.0	2	2.9	68	100.0
H	21	20.0	79	75.2	5	4.8	105	100.0
I	28	21.7	98	76.0	3	2.3	129	100.0
J	27	27.0	70	70.0	3	3.0	100	100.0
K	24	27.0	63	70.8	2	2.2	89	100.0
L	12	27.2	32	72.8	—	—	44	100.0
M	—	—	6	85.7	1	14.3	7	100.0
Actual Mentions	109	19.3	426	75.6	29	5.1	564	100.0

(Of 589 users 25, or 4.2%, did not answer the question)

* A—Motors, generators, and parts (manufacturing or repair).
B—Transformers, coils and related devices and parts.
C—Insulated wire and cable.
D—Wiring devices, connectors, etc.
E—Household and commercial appliances.
F—Switchgear, controls, relays, circuit breakers, switches, parts, etc.
G—Printed circuits.
H—Electronic components and parts (tubes, capacitors, resistors, semiconductors).
I—Electronic and communication apparatus and assemblies.
J—Aircraft and missile parts and equipment.
K—Instruments and test equipment.
L—Electrically or electronically controlled, operated, or powered tools and machines.
M—Other.

**Percent of total answering for each group.

ıgs, reactors, resistors, switches, nchros, transistors, transducers, elec- onic packaging, etc.

The next largest group, impregnat- ıg, saturating, filling and sealing was entioned in connection with mag- ɔtic amplifiers, armatures, electronic ɜsemblies, terminal blocks, plugs, ıpacitors, circuits, coils, components, ɔnnectors, motors, resistors, end ɛals, synchros, terminals, thermo- ɔuple wire, transformers, moisture roofing of all types of components, lling of voids especially in high volt- ge assemblies or for moisture bar- ers, sealing of switches, relays, con- ectors, circuit breakers, capacitors, c.

Other applications mentioned were ıany and varied including insulation f every type of component and elec- ical or electronic unit imaginable. ungus proofing was mentioned fre- uently as well as corrosion protec- on, masking, oxidation prevention, ɔamed insulation, shock resistant in- ulation media, mounting insulation, hemical resistance protection, abra- ion resistance, cushioning, rein- ɔrcement insulation, ruggedization nsulation, heat transfer medium, ter- ınination insulation, etc.

sers' Attitudes Toward olidifying Fluid Manufacturers

In an attempt to determine the ttitudes of the users toward the pro- lucers of the materials, users were sked, "What is your general opinion f the product improvement and de- elopment work of 'solidifying fluid' naterial manufacturers?" To answer his question respondents were asked o check "excellent," "good," or 'poor." As shown in table 3, it can ɔe generalized that users had a 'good" or slightly better than "good" ɔpinion of the work of the solidifying luid producers. However, the fact hat so many replies fell into the 'good" category rather than "excel- ent" should be an indication to the ɔroducers that there is plenty of room for improvement of effort. Opinions aried somewhat according to the ype of manufacturer but generally he spread between different product groups did not vary more than 10 or 5%.

"From transistor radios to computers—

one of National's 115 materials and grades will give you optimum performance in your design."

Why go on a wild goose chase from supplier to supplier for the special plastic material you need for your design? A time- and trouble-saving check with National gives you unbiased help and a material best suited to your property requirements.

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Association News

Name NEMA Divisional Heads

E. E. Helm, The Reliance Electric & Engineering Co., has been elected chairman of the newly organized Industrial Equipment Division of the National Electrical Manufacturers Association. New chairman of the Lighting Equipment Division is Clarence C. Keller, Holophane Co. Inc.

AIEE June Meeting in Atlantic City And Other Institute News

The summer general meeting of the American Institute of Electrical Engineers, sponsored by the Philadelphia section, will be held at the Chalfonte-Haddon Hall Hotel, Atlantic City, N.J., June 20-24.

Sixty-six technical sessions are planned, about half on communications, instrumentation and control, computers, basic science, and management and the remainder on aspects of power generation, transmission, and distribution.

At the annual meeting, to be held the first day, new officers will be announced and Lee A. Kilgore, Westinghouse Electric Corp., will be awarded the 1959 Lamme Medal for "analyses of synchronous machine reactances; for invention of special armature windings; and for inventions and designs related to large adjustable speed alternating current motors."

Several interesting inspection trips are scheduled.

The institute has created a 15th district by splitting the Seventh, or South West District. It will be known as the South West District. The other half of the old district has been renamed the Mid America District.

The new district will consist of New Mexico, Texas, and part of Louisiana. The Mid America District will include Kansas, Missouri, Oklahoma, and Arkansas. The changes in the districts become effective Aug. 1.

Robert F. Munier, advanced design engineer in the Motor Products Div., Wagner Electric Corp., St. Louis, Mo., has been named a Fellow of AIEE "for contributions to the thermal performance of motors, particularly in enclosed forms and small ratings."

Radiation Effects on Insulation In AIEE Pacific Meeting Program

Much of interest to those concerned with the effects of radiation on insulation will be presented at the 1960 Pacific general meeting of the American Institute of Electrical Engineers at the El Cortes Hotel, San Diego, Cal., Aug. 8-12.

A third Educational Symposium on Radiation Effects (two sessions) and a round table discussion have been scheduled. They are jointly sponsored by the subcommittees on Effects of Radiation on Insulation and Radiation Technology. A meeting of the two subcommittees will be held also.

Electrical frontiers of the space age will play a prominent role in the meeting. The technical program also will include sessions on generation and transmission of power, communications, radio and television, electronics, computers, and basic science.

Thermocouple Project

The establishment of an American Standards project on thermocouples was recommended recently by representatives of 16 national trade associations, technical societies, and industry. The purpose is to simplify the use and aid in the manufacture of thermocouples and thermocouple extension wires. The Instrument Society of America has been invited to sponsor the project.

IEC Will Meet at New Delhi

The general meeting of the International Electrotechnical Commission will be held in New Delhi, India, October 31 through November 12. The Vice President of India, Dr. S. Radhakrishnan, will speak at the opening ceremonies.

Visits to technical installations have been planned, including the National

Physical Laboratory, All India Radio Station, International Monitoring Center, and the Essential Water and Power Commission Museum.

NEMA Consumer Products Division Meets June 1-3 in Chicago

The first annual meeting of the newly organized Consumer Products Division of the National Electrical Manufacturers Association will be held June 1-3 at the Edgewater Beach Hotel, Chicago.

The new division is one of eight formed this year under NEMA's reorganization plan. It is composed of product sections whose member companies produce electric ranges, water heaters, refrigerators, freezers, dishwashers, room air conditioners, housewares and electric fans. These groups will hold separate meetings at the division convention.

Seminar on Standardization

Dr. John Gaillard, consultant on industrial standardization, will hold his next seminar on this subject in the Engineering Societies Building, New York City, June 20-24. The seminar is designed to assist management in organizing the administrative setup and procedure for handling standardization work, and training staff men in the functions of the standards engineer, including the writing of specifications.

For details and registration, write to Dr. John Gaillard, 135 Old Palisade Road, Fort Lee, N.J.

Establish Kipping Award In Organosilicon Chemistry

An annual F. S. Kipping Award in Organosilicon Chemistry under the auspices of the American Chemical Society has been established by Dow Corning Corp. One thousand dollars will be given to a scientist for distinguished contribution to knowledge of organosilicon compounds, now popularly known as "silicones." The selection will be made by a committee of the American Chemical Society and will be open to scientists engaged in non-commercial research anywhere in the world.

Professor Frederic Stanley Kipping of Nottingham University, England, published 119 papers on organosilicon chemistry during the 37 years, 1899 to 1936, that he worked in the field. He is well known as the co-author with W. H. Perkin of two textbooks on organic and inorganic chemistry used by generations of college students.

Second EIA Conference on Value Engineering, Sept. 7-8

Disneyland, Los Angeles, will be the site of the Second EIA Conference on Value Engineering, Sept. 7-8. The conference will be divided into two concurrent sessions: one will be devoted to discussion on topics of interest to those already performing or directing value engineering; the other will be designed for those not yet experienced in value engineering and will explain what it is and how to carry it out.

Papers will be presented on such aspects of value engineering as organization, value engineering in the military, contractual problems, and value engineering project work.

On the second afternoon there will be a joint session devoted to a discussion of "Value Engineering's Most Urgent Problem."

Additional information should be requested from the nearest EIA office: 11 West 42nd St., New York 36, or 1717 N. Highland Ave., Hollywood, Cal.

Reliability Training Course In Chicago, June 5-11

A reliability training course consisting of lectures and discussion of engineering, statistical, and management techniques vital to an effective reliability program will be conducted at the Sheraton Towers Hotel in Chicago, June 5-11. The course will be presented at later dates in other cities, including Dallas-Ft. Worth, Kansas City, Utica, Los Angeles, and Philadelphia. It is sponsored by the Professional Group on Reliability and Quality Control of the Institute of Radio Engineers and the Electronic Division of the American Society for Quality Control.

The Chicago course will be in session from June 6 through June 11. Classes will run from 9 am until 5 pm, with a two-hour luncheon period. Special evening lectures will also be

presented Monday through Friday.

Two identical courses will be conducted concurrently, with registration in each limited to 35 persons. The course fee of $225 includes tuition, all course materials, room, and three meals a day from Sunday supper until the following Saturday at noon.

For further information, contact A. R. Roddey, Institute for Defense Analysis, Weapons System Evaluation, Pentagon Building, Washington 25, D.C.

Request Papers for SPE Retec on Plastics in Business Machines

Papers are being solicited for a Regional Technical Conference on "Plastics in Business Machines," to be conducted Sept. 22 by the Binghamton, (N.Y.) section of the Society of Plastics Engineers, Inc. Areas of interest include applications or case histories, close tolerance molding, mold design and building for precision, new materials for business machine applications, plastics for wear applications, the industrial designer looks at plastics for business machines, and end use testing and/or specifications. Offers or abstracts of papers should be sent to program chairman Leroy N. Chellis, IBM Corp., Endicott, N.Y.

Plan 1961 Symposium on Temperature Measurement and Control

A national symposium on "Temperature—Its Measurement and Control in Science and Industry" will be held in Columbus, Ohio, March 27-31, 1961. Jointly sponsored by the American Institute of Physics, the Instrument Society of America, and the National Bureau of Standards, with other societies and governmental agencies cooperating, it will be the first conference of this breadth and scope since the New York conference on the same subject in 1939.

The symposium will be aimed at the fundamentals of temperature measurement and will provide an authoritative blending of papers on the meaning of the temperature concept as well as analytical theory, with appropriate emphasis on instrumentation and engineering aspects. Interests from cryogenics to ultra high plasma tempera-

ture will also be covered.

Those interested in contributing to the program should contact chairman Dr. C. M. Herzfeld, Heat Div., National Bureau of Standards, Washington 25, D.C.

R. D. Thomas Jr. Elected President of Welding Society

R. D. Thomas Jr., president of Arcos Corp., has been elected president of the American Welding Society. Other new officers announced at the recent 41st annual meeting of the society included three vice presidents: A. F. Chouinard, director of research and development, National Cylinder Gas Co. (re-elected); J. H. Blankenbuehler, design engineer, Hobart Brothers Co.; and C. E. Jackson, associate manager of electric welding development, Linde Co. Development Laboratories. New district directors are: James M. Shilstone, co-owner of the Shilstone Testing Laboratory, Baton Rouge, La., Southeast District; David P. O'Connor, general power shops foreman, City of Los Angeles, Department of Water and Power, Western District; George W. Kirkley, welding consultant and welding engineer, Electric Boat Div., General Dynamics Corp., New England District; and Lester L. Baugh, welding process engineer, Allis-Chalmers Manufacturing Co., Central District. Four directors-at-large were also elected. They are: Dr. Robert D. Stout, chairman of the department of metallurgy, Lehigh University, Bethlehem, Pa.; John Mikulak, assistant to the vice president in charge of manufacturing, Worthington Corp.; Roy McCauley, chairman of the department of welding metallurgy, Ohio State University; and Dr. Ernest F. Nippes, professor of metallurgical engineering, Rensselaer Polytechnic Institute.

Annual Meeting of ASTM in Atlantic City, June 26-July 1

A searching look into the present state of knowledge of several facets of materials science, including ductile ceramics, will highlight the 63rd annual meeting of the American Society for Testing Materials at Chalfonte-Haddon Hall, Atlantic City, N.J., June 26-July 1, 1960. The society's new Division of Materials Sciences has organized an all-day program fo June 27 consisting of two symposi related to basic materials knowledg "Recent Progress in Materials Sc ences" and "The Nature and Origi of Strength of Materials." A pap on the "Status of Ductile Ceramic Research" will be presented by E. Parker of the University of Californi

Close attention also will be given solar energy, nuclear fuel element d velopment, low temperature properti of high-strength aircraft and missi materials, acoustical fatigue, radi tion effects, radiation dosimetry, an many other topics.

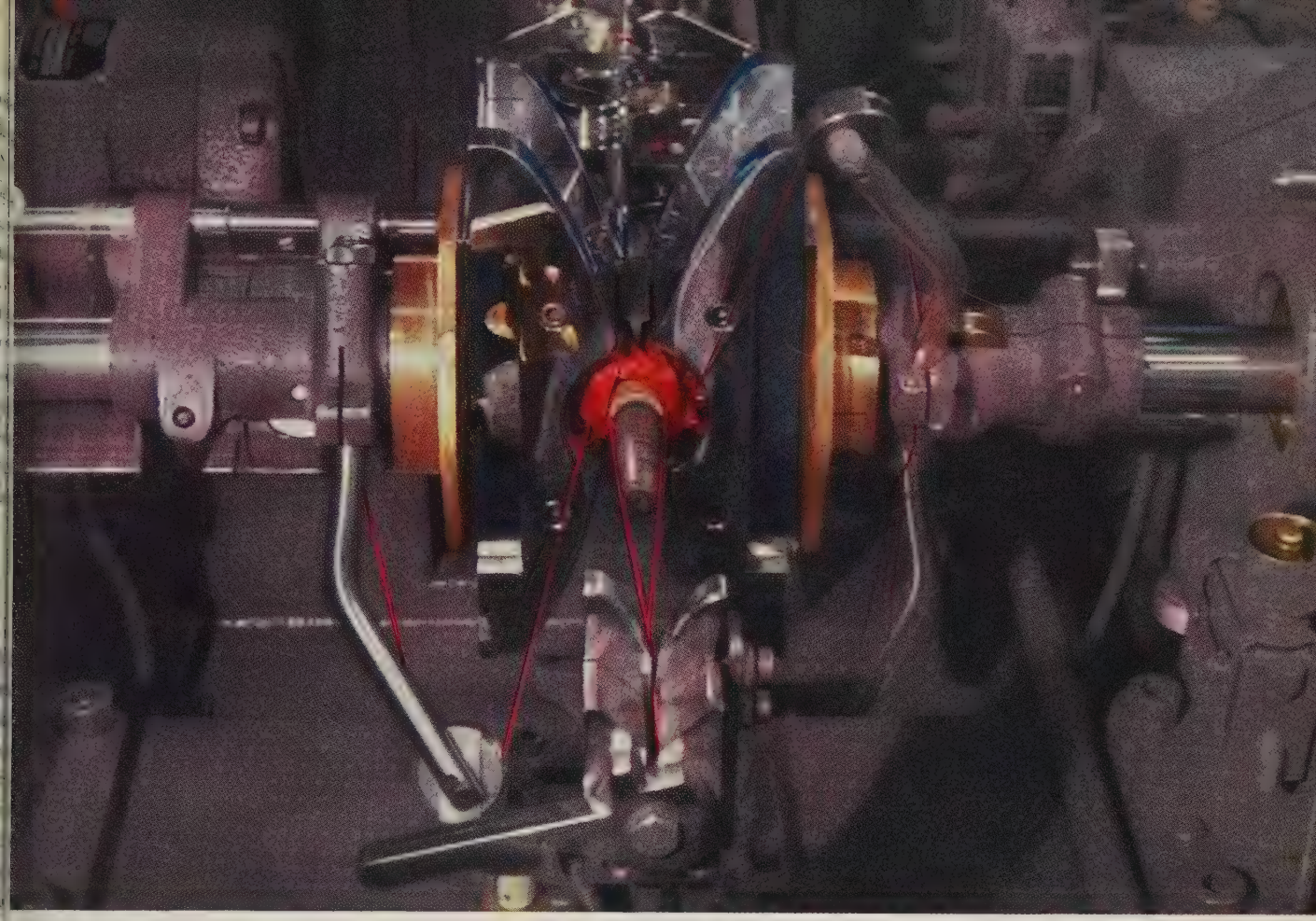
Military Electronics Convention In Washington, June 27-29

Over 4,000 engineers are expecte to attend the fourth National Conve tion on Military Electronics in Was ington, D. C., June 27-29. The mee ing is jointly sponsored by the Pr fessional Group on Military Electro ics of the Institute of Radio Engineer and the Air Research and Develo ment Command. Headquarters will H at the Sheraton-Park Hotel.

Highlighting this convention wi be five confidential sessions sponsore by ARDC, and 15 unclassified sessio covering such topics as space tec nology, space electronics, guidanc and control, and communicatio equipment. In addition, the loc PGMIL chapter has arranged an in teresting program on the morning c June 27. This will be a panel discus sion by members of the Army, Navy and Air Force, including such perso as Vice Admiral J. T. Hayward (Dep uty Chief of Naval Operations—De velopment, U. S. Navy) and Majo General L. I. Davis (Assistant Deput Chief of Staff—Development, U. S Air Force).

Vinyl Jacket For Underground Wire

A vinyl jacket selected for abrasio resistance and chemical inertness i now being used to encase direct buria wire and cable produced by Superio Cable Corp., Hickory, N.C. The Geo vinyl resin used is produced by B F. Goodrich Chemical Co.



For more details on Anaconda Nylac's unique combination of useful characteristics, please turn the page—

When you must wind fast, tight, and meet high temperatures, too, SPECIFY NYLAC SOLDERABLE MAGNET WIRE

The faster you wind and the tighter your space factor—the more you should consider the advantages offered you by Anaconda Nylac Magnet Wire.

For Nylac is Anaconda Analac with a tough, Nylon film outer covering. The Nylon provides outstanding slipperiness and abrasion resistance—these tight-winding characteristics enable you to make compact, easily shaped, uniform coils.

Yet Nylac incorporates many features of Analac. For example, it gives you easy, fast solderability without stripping. It also has excellent moisture resistance.

In addition, Nylac offers you high dielectric strength, high thermoplastic flow temperatures, excellent flexibility, resistance to hot varnishes and potting compounds. *And—it meets all 130°C (AIEE Class B) requirements.*

So by combining Nylon, an old and industry-accepted insulation, with a newer but thoroughly proven film covering—*Analac*—Anaconda's *Nylac* is a new solderable Class B Magnet Wire especially designed to overcome the strains of today's high-speed winding equipment and tight space factors.

The next time you face these and other winding problems, contact your nearest Anaconda Wire & Cable Sales Office. Our technical staff and Research and Development Laboratory facilities are available to give you every assistance possible. See the Man from Anaconda. Or write: Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

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about

NYLAC MAGNET WIRE

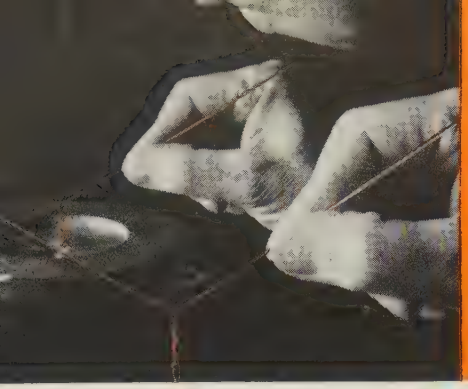
ANATHERM 155°C (AIEE Class F)
high temperature resistance

EPOXY 130°C (AIEE Class B)
superior compatibility

PLAIN ENAMEL 105°C (AIEE Class A)
low-cost enameled magnet wire

FORMVAR 105°C (AIEE Class A)
proven dependability

ANALAC 105°C (AIEE Class
solderable magnet wire



Important Facts about NYLAC MAGNET WIRE

Anaconda® Nylac film-coated magnet wire has a Nylon enamel outer surface over a film of Anaconda Analac (polyurethane) insulation. Nylac is a solderable wire that meets 130°C (AIEE Class B) thermal test requirements. It has outstanding windability and varnishability for severe process conditions, and exhibits excellent heat shock characteristics.

TECHNICAL PROPERTIES

ELECTRICAL PROPERTIES

Nylac has high dielectric strength. It has excellent electrical properties for all applications except high "Q" coils where dissipation factor should be as low as possible.

DIELECTRIC STRENGTH

Moisture environment of sample	Volts per mil of insulation
Dry	3580
Room Conditions	2560
Six hours at 100% relative humidity at 100°F	1310

DIELECTRIC CONSTANT AND DISSIPATION FACTOR

(Measured with capacitance bridge)

Frequency Cycles Per Second	Dielectric Constant		% Dissipation Factor	
	35°C	100°C	25°C	100°C
10^2	3.5	10.7	2.4	11.4
10^3	3.4	8.9	2.2	21
10^4	3.5	6.2	2.8	18
10^5	3.3	4.8	2.8	6

MECHANICAL PROPERTIES

Nylac is a strong flexible insulation. It adheres well to the conductor. Nylac wire survives severe abrasion, stretch and flexing in high-speed, high-tension winding operations due to the tough Nylon overcoat. The wire will take short radius corner bends without cracking.

CHEMICAL PROPERTIES

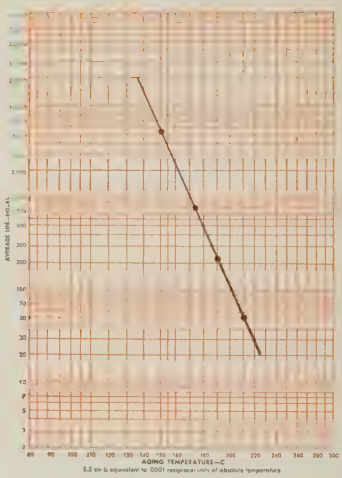
Nylac has outstanding resistance to chemical attack. It will withstand 24 hours' immersion at room temperature in solvents including naphtha, Xylol, ethyl alcohol, chlorothene, methanol, and in 5% sulfuric acid and 1% potassium hydroxide.

THERMAL PROPERTIES

THERMAL STABILITY

Nylac meets the 130°C (AIEE Class B) requirement. Graph 1 indicates 20,000 hours' life at 135°C for unvarnished samples. Varnished sample data, available on request, indicates over 30,000 hours at 130°C.

Nylac is not recommended for use where severe thermal overloads may be encountered.



NYLAC MAGNET WIRE UNVARNISHED AIEE 57 TEST

HEAT SHOCK
1 HR. AT 155°C

Prestretch	Mandrel Diameter (Multiple of Wire Diam.) 1x	3x	5x	10x
0%	pass	pass	pass	pass
10%	pass	pass	pass	pass
15%	pass	pass	pass	pass
20%	pass	pass	pass	pass
25%	pass	pass	pass	pass

Thermoplastic flow temperature

265°C using 5°C per minute rate of rise

SOLDERABILITY

Nylac wires solder without pre-stripping at practical solder temperatures.

Wire Size	Time-Seconds	Solder Temperature	Sample
15—18	15	360°C	Twisted Pair
19—25	10	360°C	
26—30	4	360°C	Wrap on 20 gage mandrel
31—46	4	360°C	

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FORMVAR . . .
better than ever for broad range hermetic use

Now, a new magnet wire enamel formulation based on FORMVAR resins sets a new standard of performance in hermetic units. Proved in the field as well as the laboratory, the new formulation maintains the unequalled physical and chemical properties of a standard FORMVAR-with-phenolic enamel and also offers these important features:

1. Excellent resistance to attack by liquid or gaseous R-22 refrigerant.
2. Shows no physical softening with heat and pressure indicating best protection against short time, high overload stress on motor windings.
3. Maximum insolubility in almost all conventional solvents.
4. Outstanding resistance to hydrolysis.

The development of this new enamel represents a major step forward in the technology of insulating enamels based on FORMVAR resins. The enamel or coated wire is now commercially available from your regular supplier under the FORMETIC or other trademark.

Why not consult your supplier for more details. It will pay you real dividends in trouble-free performance.

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Books

Plated-Thru Holes for Thru Connections on Printed Wiring Boards. Detailed report on the reliability of plated-through holes in printed wiring boards contains a number of independent studies made by major suppliers of military electronics as well as findings of test laboratory. Listings of large military programs and their prime contractors now using and planning to use plated-through holes are included. Some 40 charts and illustrations are shown to highlight the results of comparison and laboratory studies. 59 pages, $1. Order from the Publications Dept., Photocircuits Corp., Glen Cove, Long Island, N.Y.

1960 Guide to NEMA Standards Publications. Booklet contains descriptions of all existing NEMA standards publications, including 20 new books produced last year. 18 pages. Copies of the guide and a price list may be obtained without charge from the National Electrical Manufacturers Assn., 155 East 44th St., New York 17, N.Y.

ASTM Standards on Electrical Insulating Liquids and Gases D-27. Contains 48 standards concerning liquid electrical insulating materials. Rapid developments in liquid insulation should make this first edition helpful to those concerned with high voltage transmission problems. Hard cover, 336 pages, 6″ x 9″, $4.25. Order from the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

NEMA Standards

The following new and revised publications may be ordered from the National Electrical Manufacturers Assn., 155 East 44th St., New York 17.

SG 6-1960, Power Switching Equipment. Contains information concerning the rating, performance, testing, and application of the following types of power switching equipment: air and interrupter switches, bus supports, accessories, and outdoor stations. Terms are defined and instructions are given for installation, operation, and care of equipment. $3.

TR 17-1960, AIEE-FEMA-NEMA Standards Publication for Arc Furnace Transformers. Covers electrical characteristics and mechanical features of 3-phase, 60-cycle, 2-winding, mineral-oil-immersed indoor transformers rated 250 to 35000 kva and 2400 to 34400 volts, inclusive, and used for supplying electric power to direct arc ferrous-melting furnaces. 70 cents.

ASA Standards

The following new standards publications may be ordered from the American Standards Assn., 10 East 40th St., New York 16.

C83.23-1960, Method for the Determination of the Elastic, Piezoelectric, and Dielectric Constants of Piezoelectric—The Electrochemical Coupling Factor. 75 cents.

IEC Publication 72-1, Recommendations for the Dimensions and Output Ratings of Electric Motors. This new international standard recommendation constitutes the first part of the third edition of Publication 72. Part 1 deals with foot-mounted a-c induction motors with shaft heights between 2⅝″ and 12½″ for voltages up to 600 volts and for frequencies of 50 and 60 cps (Hz). It includes tables of standard dimensions, shaft extensions, and output ratings. $2.40.

EIA Standards

The following new standards publications may be obtained from the Electronic Industries Assn., Engineering Dept., 2260 Salmon Tower, 11 W. 42nd St., New York 36.

RS-235, Color Code for Traveling Wave Tube Wired Leads. New material from standards proposal 627. 4 pages, 25 cents.

RS-236, Color Coding Semiconductor Devices (Diodes and Rectifiers). New material from standards proposal 586. 4 pages, 25 cents.

AIEE Standards

The following publications may be obtained from the American Institute of Electrical Engineers, 33 W. 39th St., New York 18.

No. 15, Industrial Control Apparatus. New American Standard (ASA C19.1-1959) contains information on definitions, general standards, contactors, resistors, enclosures, autotransformers and reactors, pushbuttons, master controllers, accessories, brakes, a-c general purpose controllers, control centers, d-c general purpose controllers, controllers for steel mill service, and crane service classifications. 37 pages, $2.20.

No. 22, Air Switches, Insulator Units, and Bus Supports. 30 pages, $1.80.

Aircraft and Missiles Electric Systems Guide. Published in the following four parts.

750.1, Contains sections 000—Introduction, 100—Criteria for the Electric System, 200 — Principal Subdivisions of Electrical Systems, and 300—Selection of the System. 13 pages, 50 cents.

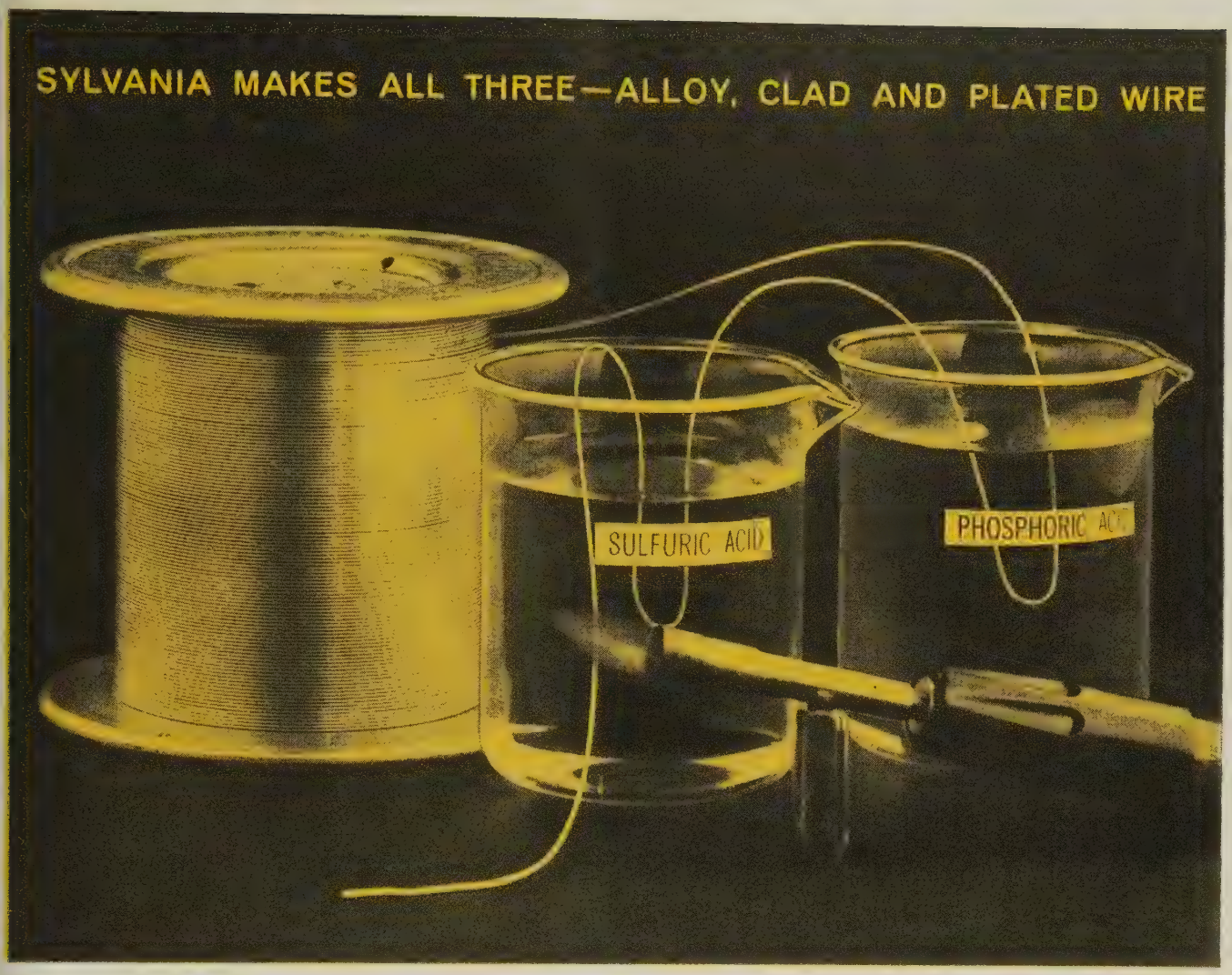
750.4, section 400 — Installation Practices. 14 pages, 50 cents.

750.5, sections 500 — Equipment Characteristics, and 800—Electric System Design Procedures. 52 pages, $1.40.

750.11, appendices I—Characteristics of A-C Generators Affecting Their Application, II—Distribution System Design, and III—Symmetrical Components. 37 pages, $1.10.

No. 805, Test Procedure for A-C 400-Cycle-per-Second Aircraft Induction Motors. 20 pages, 60 cents.

No. 806, Test Procedure for Aircraft A-C Generators. 23 pages, 70 cents.



New Sylvania nickel-clad silver 20% wire passes the acid test—beats the heat

—another reason why Sylvania gives unbiased recommendations on wire

New Sylvania nickel-clad silver 20% wire has all these outstanding properties: excellent electrical conductivity, corrosion resistance superior to silver wire, ability to withstand temperatures up through 1500°F. As a result, it's ideal for electrical hookup wire where conditions call for critical service, long life under oxidizing, corrosive or high-temperature environments.

This new wire is available from .005″ to .125″ diameter, in a variety of tempers from dead soft to full hard.

It is another example of how you can simplify your design and specification problems by getting a Sylvania recommendation on wire. Sylvania knows wire, knows the particular advantages of each kind. In fact, of all major manufacturers, only Sylvania makes all three types of bare wire—alloy, clad and plated.

Why not get full details and timesaving technical assistance today. Simply write Sylvania Electric Products Inc., Parts Division, Warren, Pennsylvania.

SYLVANIA

Subsidiary of **GENERAL TELEPHONE & ELECTRONICS**

GENERAL SYSTEM

Print Ins. 36 on Reader Service Card

Industry News

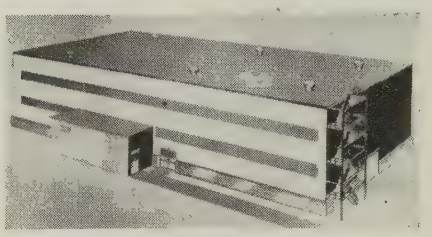
The Grover Co., Detroit tube system manufacturer, has become a subsidiary of *Powers Regulator Co.* of Skokie, Ill., manufacturer of automatic temperature controls.

Allis-Chalmers Mfg. Co., Milwaukee, has combined its industrial and general products divisions into a new operating unit called *Industrial Equipment Div.* with W. M. Wallace a vice president and general manager of the new division.

Hercules Powder Co., Wilmington, Del., reports 1960 first quarter earnings of 64 cents per share of common stock. Comparable figure for 1959 was 57 cents. Net sales and operating revenues for the quarter were $73,452,522, compared wtih $64,174,562 for the first quarter of 1959.

Research activities of *Bell & Howell Co.*, Chicago photographic equipment manufacturer, and its electronic instrument manufacturing subsidiary, *Consolidated Electrodynamics Corp.*, Pasadena, Cal., are being combined into a single, expanded research division at Pasadena having 30% more personnel than the two previous departments. New research division heads are Dr. Charles F. Robinson, director of research, John G. Heiland, associate director, and Dr. Kenneth W. Gardiner, assistant director. Sales of the company and its subsidiaries for the first quarter of 1960 were $24,068,000, compared with $20,324,000 for the first quarter of 1959. Net earnings were $573,000, or 15 cents per share, compared with $739,000, or 20 cents per share, for the first quarter of 1959.

General Electric Co. reports sales for the first quarter of 1960 were $957,433,000, off 2% from 1959 first quarter sales. Net earnings amounted to $52,614,000, or 60 cents a share, almost identical to corresponding figures for last year. At Waterford, N.Y., G-E's *Silicone Products Dept.* is constructing a facility for the production of silicone fluids, dispersions, emulsions, specialty products, and chemicals. When completed in October, it



will add 15,000 sq ft to existing facilities.

A 6,000 sq ft addition to the main plant of *Northern Plastics Corp.*, La-Crosse, Wis., laminated plastics manufacturer, will be completed this month.

A new firm, *Circuit Materials Corp.*, New Brunswick, N.J., has acquired the adhesive coated copper foil business previously handled by the *Permacel Div.* of *Johnson and Johnson.* The products are used in the manufacture of printed circuits. Dr. Steven J. Karwan, who was product manager for these materials at Permacel, is president of the new firm.

Alva Allen Industries, Clinton, Mo., has appointed Matt P. Hirt, Shawnee, Kan., to represent its line of power punch presses and accessories in a large part of the Midwest.

Alpha Wire Corp., insulation tubing and wire manufacturer, has been acquired by *Loral Electronics Corp.*, electronic systems producer. Alpha will operate independently as a subsidiary, with all Alpha personnel continuing in present capacities.

Multi-Amp Electronic Corp., Union, N.J., has named *Honolulu Electrical Products Co. Ltd.*, Honolulu, as Hawaiian representative for the firm's electrical test instruments.

Hitemp Wires Inc., Westbury, Long Island, has been licensed to make and sell wire and cable zip-on tubing patented by *Miracle Adhesives Corp.*, Bellmore, L.I., N.Y.

The Light & Power Utilities Corp., Memphis, Tenn., lighting fixture manufacturer, has purchased the *Locust Lighting Co.*, St. Louis manufacturer and distributor of church lighting and specialized commercial and domestic lighting fixtures. Locust products will be manufactured at the L & P Memphis plant after the company moves to its new $600,000 headquarters plant at Olive Branch, Miss., this summer. The new 112,000 sq ft factory will be four times larger than L & P's present plant.

Insulation Systems, Pittsburgh, Pa., distributor of electrical insulating materials, has been appointed a distributor of molding materials made by the *Reinforced Molding Corp.*, Monroeville, Pa.

Plans to build a new technical ceramics plant at Laurens, S.C., have been announced by *American Lava Corp.*, Chattanooga, a subsidiary of Minnesota Mining & Manufacturing Co., St. Paul. Construction of a 50,000 sq ft plant will begin as soon as final arrangements for acquisition of a 100-acre site are completed.

Prices have been reduced up to 20% on model XV-100/6299 sockets for use with General Electric's GL6299 triode and other tube types by *Instruments for Industry Inc.*, Hicksville, N.Y., manufacturer of countermeasures equipment and electronic components.

Engineering and production of AM, FM, and TV broadcast transmitting equipment by the *Standard Electron-*

ics Div., Reeves Instrument Corp., is now under way in a new 31,000 sq ft plant at Farmingdale, N.J.

Rheem Manufacturing Co., manufacturer of a wide range of electronic and other equipment, has formed a subsidiary, *Rhebo Corp.*, Mountain View, Cal., to design and build automatic machines for electronics and other industries that fabricate and assemble small precision parts.

Case Brothers Inc., manufacturer of electrical insulating papers and pressboards, has begun construction of a $2,500,000 plant in Brattleboro, Vt.

A 180-acre electronic data processing center will be built next year in Newton, Mass., by *Sylvania Electronic*

Cables manufactured by Reynolds Metals Company, Richmond, Virginia. Covering extruded of Tenite Polyethylene.

Why Reynolds covers these aluminum conductors with TENITE POLYETHYLENE

To obtain the highest possible performance from their secondary distribution and service line cables, Reynolds Metals Company chooses Tenite Polyethylene as a covering material.

Tenite Polyethylene is manufactured under as rigid a system of quality control as Reynolds' own aluminum conductors, and makes a tough, weatherproof, fast-stripping covering material which offers high dielectric strength and resistance to abrasion, heat, moisture, chemical attack and stress cracking. It remains flexible even at sub-zero temperatures and its light weight permits easy handling and wide spans. Users report that it gives long service life without festooning or splitting.

Tenite Polyethylene is easily extruded as jacketing or insulation for many diverse applications, from coaxials to control cables, from TV lead-ins to telephone wires. For a material with outstanding electrical, physical and chemical properties, specify Tenite Polyethylene. For further information, write EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

Both natural and black electrical grade Tenite Polyethylene are available to cable manufacturers in a unique spherical pellet form which flows freely in the extrusion process and in "air-veying" of bulk shipments from truck to bin.

TENITE®

POLYETHYLENE

an Eastman plastic

Systems Div., Sylvania Electric Products, Inc. It will provide about 200,000 sq ft for development of data processing techniques, equipment, and systems. In Needham, Mass., a Systems Engineering and Management Operation has been established to represent Sylvania and the parent company, General Telephone & Electronics Corp., in all activities relating to large military systems contracts. Sylvania's *Semiconductor Div.* at Hillsboro, N.H., has expanded transistor and diode manufacturing operations through enlargement of the existing installation and leasing of additional laboratory and production space at the Monadnock Research Center, North Branch, approximately five miles from the Hillsboro plant.

Stockholders of *Continental Electric Co.*, Geneva, Ill., manufacturer of electronic tubes, have voted to change the company name to *Cetron Electronic Corp.*

The Applied Engineering Co. Inc., Orangeburg, S.C., has been named sales representative in North and South Carolina and Georgia for multicomponent liquid resin metering and mixing systems manufactured by the *Mitchell Specialty Div.* of *Industrial Enterprises Inc.*, Philadelphia.

Muro Plastics Co., Seattle, has been appointed to represent *Modern Plastic Machinery Corp.*, Clifton, N.J., in Alaska, Hawaii, northwestern United States, and western Canada.

Electrical insulation materials are now being stocked in a new building in Orlando, Fla., by *Brownell Distributors Inc.*

The *Hertz Engineering Scholarship Foundation*, Los Angeles, has announced plans for granting future scholarships in all fields of engineering. Previously, scholarships were awarded only in electrical and mechanical engineering.

Keasbey & Mattison Co., Ambler, Pa., asbestos tape and sleeving manufacturer, has opened new sales offices in Los Angeles and St. Louis.

Materials Electronic Products Corp., manufacturer of thermoelectric modules for cooling applications, has acquired 8,000 sq ft of space adjoining the present plant site in Trenton, N.J. The additional space is being used for production, research, and development.

Oak Manufacturing Co., Chicago electronic and electrical component parts manufacturer, has formed a wholly-owned subsidiary, *Oak Electronics Corp.*, in Culver City, Cal., to produce rotary and push button switches.

Power Designs Inc., manufacturer of power supply equipment, is now

operating in a new plant in Westbury, L.I., N.Y.

The Special Products Div., *Whirlpool Corp.*, has been expanded to include a commercial laundry and drycleaner equipment division. John M. Crouse has been appointed general manager.

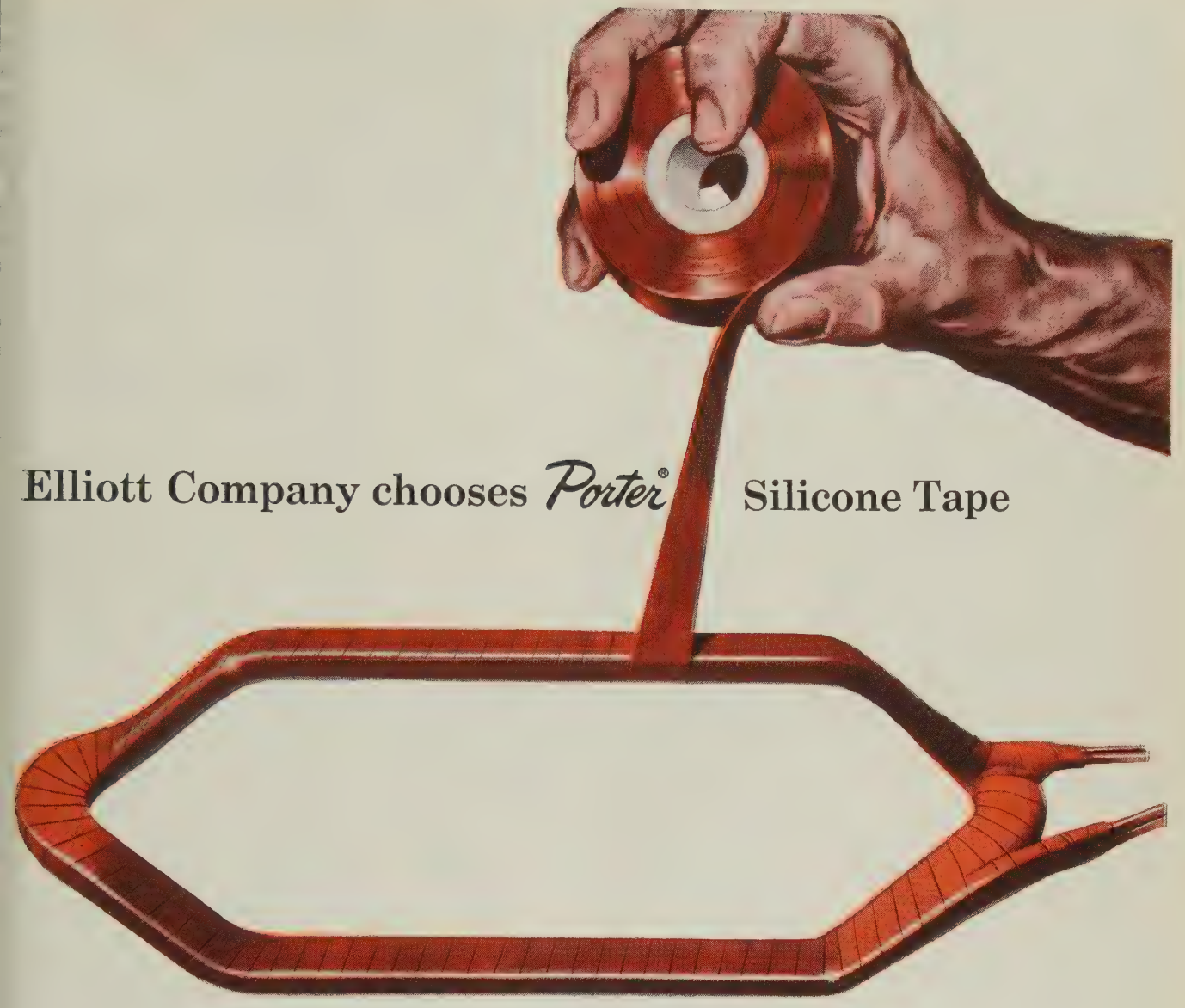
A new company of wire industry specialists, *Thompson Associates*, Menlo Park, Cal., has been formed to provide engineering services and to act as manufacturers representatives and wire mill consultants.

Hussmann Refrigerator Co., St. Louis, plans to expand its multi-mil-

lion dollar plant at Haddonfield, N.J., by enlarging it from 130,000 sq ft of manufacturing area to 192,000 sq ft.

General Testing Laboratories Inc., a firm which provides environmental testing services for electronic, electrical, electro-mechanical, and other products, has moved to a modern, 10,000 sq ft industrial plant in Moonachie, N.J.

Sterling Varnish Co., Sewickley, Pa., has appointed *Vulcan Electric Distributors Inc.*, Birmingham, Ala., as manufacturers representative for its insulating varnishes and compounds in Mississippi, Alabama, Tennessee, Western Georgia, and Western Florida.



Elliott Company chooses *Porter*® Silicone Tape

for mechanical stability and extended motor life!

After extensive research into new materials and methods, Elliott Company, a division of Carrier Corporation, has developed the first really mechanically-adequate silicone insulation system—with "Porter" Silicone Tape. Vulcanized into a void-free homogeneous structure, "Porter" Silicone Tape provides outstanding mechanical and sealing properties for applications requiring class H insulation. In addition to flexibility and moisture protection, the Elliott "Fabri-Lastic" system provides durability and toughness as well as excellent thermal stability at high temperatures.

Thermoid Division offers the widest range of silicone tapes on the market today. And continuous research and development is being conducted to make available silicone elastomer materials with characteristics to meet customers' constantly changing needs. Thermoid Division engineers are available to work with you, as they worked with the Elliott Company, to develop the right combination of silicone elastomer and compatible materials for your requirements.

For fresh stocks of "Porter" Silicone Tape or information on special design characteristics, write *Thermoid Division, H. K. Porter Company, Inc., 200 Whitehead Road, Trenton 6, N.J.*

Ask for this free brochure with actual tape samples.

THERMOID DIVISION PORTER **H. K. PORTER COMPANY, INC.**

PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

Print Ins. 39 on Reader Service Card

People in the News

Edward J. Guelpa has been appointed general manager of the Western Div. of Taylor Fibre Co. at La-Verne, Cal. after previously serving as Western Div. district sales manager. *Peter J. Longarzo* and *Thomas E. Coyle* have both been appointed sales engineers in the New York branch office for the laminated plastics and fibre manufacturer.

E. J. Guelpa

J. G. Staudt

John G. Staudt has been named president of the Dobeckmun Co., a Div. of the Dow Chemical Co., Cleveland.

Raymond E. Lafferty, previously assistant chief engineer with the Daven Co., has been appointed chief engineer, Boonton Electronics Corp., Morris Plains, N.J.

Royal Industries Inc., Los Angeles, electronics manufacturer, has appointed *P. G. Smith* as executive vice president.

Theodore R. Kennedy, former chief engineer of Magnathermic Corp., has joined Inductotherm Corp., Delanco, N.J., induction heating manufacturer as engineering assistant to the president.

Carrier Corp., Syracuse, N.Y., has named *Henry W. Kuklinski* as engineering manager for transportation air conditioning and refrigeration equipment, while *Dr. John S. Burlew* has been appointed director of research, and *Dr. Dewey J. Sandell* has been named director of development for the Research and Development Div.

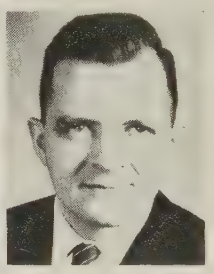
Andrew Ireland has been appointed an infrared systems consultant for the Electronics Systems Engineering Dept. at Servo Corp. of America, Hicksville, L.I., electronics firm.

Ram Chemicals Inc., Gardena, Cal. has appointed *Gene Gordon* as sales manager and *Tom McGowan* and *Clifford Hoffman* as technical sales engineers.

Philco Corp.'s Government and Industrial Group has appointed *Richard Holden,* Rear Admiral (USN, ret.), as director of advanced systems development dept. at Philadelphia.

Union Carbide Plastics Co., New York City, has appointed *Fred Wurtzell* as manager, wire and cable market. He joined Union Carbide in 1942. Succeeding Wurtzell as assistant regional manager in the New England region is *Gerrit V. Lydecker* who has been in the Detroit office.

Fred Wurtzell



G. V. Lydecker

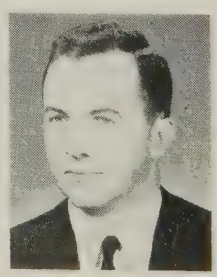
Sylvania Electric Products Inc. has appointed *Peter J. Grant* as president of Sylvania Home Electronics Corp., Batavia, N.Y. He joined the firm in 1951. Also at Batavia, *Robert E. Kenoyer* has been named vice president and general manager, a newly created position, after previous service as corporate controller. At Needham, Mass., *Richard W. Couch* has been appointed manager of the Systems Engineering and Management Operation of Sylvania Electronic Systems Div. He joined Sylvania in 1954. At Warren, Pa., *Charles D. Seekings* has been named engineer-in-charge of product engineering of the Parts Div. plastics plant of Sylvania. He will be responsible for all product engineering activities in the plastics operation. At Needham, Mass., *Frederick J. Anderson* has been appointed director of engineering for the Data Systems Operations of Sylvania Electronic Systems Div. He had previously served as manager of the Data Processing Laboratory at the Data Systems Operations.

F. J. Anderson

J. R. Donnalley

Dr. James R. Donnalley, formerly manager of manufacturing at General Electric Co.'s Silicone Products Dept., has been appointed general manager of the Insulating Materials Dept. in Schenectady. He succeeds *Theodore C. Ohart,* who has been appointed general manager of the Wire and Cable Dept., Bridgeport, Conn. Dr. Donnalley joined G-E in 1943. At Pittsfield, Mass., *William R. Smart* has been named marketing manager of the Distribution Transformer Dept., succeeding *James L. Elrod,* who becomes manufacturing programming manager in the department. The Silicone Products Dept. has named *James E. Hamlin* as sales representative for the east central district with headquarters in Cleveland and *R. L. Harden* as sales representative for the eastern district with offices in Philadelphia.

Dr. George R. Mitchell has been promoted from assistant manager to manager of research and development for The Glastic Corp., Cleveland manufacturer of fiber glass reinforced plastic electrical insulation.



G. R. Mitchell

J. F. Konkolosky

Joseph F. Konkolosky has joined Columbia Tape Mills Inc., East Green-

REPORT FROM

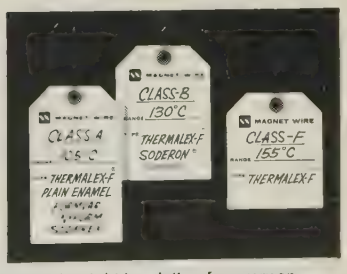
ESSEX MAGNET WIRE LABORATORIES*

*TECHNICAL INFORMATION CENTERS FOR RESEARCH, DEVELOPMENT, VALUE ANALYSIS AND ENGINEERING

NOW AVAILABLE

Comprehensive Data on Magnet Wire Encapsulation

A series of thermal aging tests were run by Essex Magnet Wire Laboratories to determine the compatibility of a number of magnet wires with encapsulating compounds. This data has been compiled into a test report which can be used as a guide in wire selection. Write for the complete test report or consult your Essex Magnet Wire salesman about the Essex Continuing Magnet Wire Testing Programs.



The right insulation for every application with Essex Magnet Wire

MAGNET WIRE DIVISION ESSEX WIRE CORPORATION, Fort Wayne, Indiana

Manufacturing Plants: Anaheim, Calif.; Fort Wayne, Ind.; and Hillsdale, Michigan
National Network of Warehouses and Sales Offices . . . Call Your Local "Essex Man"
Print Ins. 40 on Reader Service Card

ville, Pa., woven fiber glass tape manufacturer, as vice president and sales manager. He formerly was vice president of Mitchell-Rand Mfg. Co., New York insulation distributor.

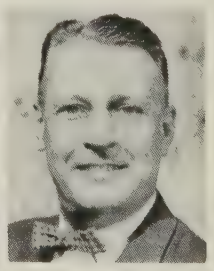
Bruce R. Goss, ceramic engineer, has joined Saxonburg Ceramics Inc., Saxonburg, Pa.

Dr. Alan D. Franklin has been appointed chief of the Mineral Products Div. of the National Bureau of Standards, Washington, D.C. He will direct research on properties of non-metallic inorganic solids including ceramics, glass, refractory oxides, etc.

At the Lansdale Div. of Philco Corp., Lansdale, Pa., *Stephen L. Levy* has been appointed assistant to the vice president and general manager after previously serving as manager of commercial engineering. *H. Kenneth Ishler* has been named general manager of semiconductor operations, while *Raymond M. Cotter* has been appointed director of manufacturing for semiconductor operations. *George W. Pratt* has been appointed director of engineering service. *John M. Palmer* has been named general manager of tube operations. And *Howard T. Steller* has been named plant manager for the division's Spring City, Pa., transistor plant.

American Super-Temperature Wires Inc., Winooski, Vt., has appointed *Richard D. Hoyt* as vice president in charge of sales and *Oakley F. Hoyt* as vice president in charge of market research and advertising. Both men have supervised sales for the company since it was organized in 1955. Their headquarters will continue to be in Princeton, N.J.

R. D. Hoyt



O. F. Hoyt

Howard S. Gleason, formerly with Stromberg-Carlson, has been appointed assistant to the president of Southwestern Industrial Electronics Co., a Div. of Dresser Industries Inc., Houston electronic manufacturer.

Harry K. Collins has been appointed executive vice president and general manager of the Paraglas Div. of Air Logistics Inc., Pasadena, Cal., plastics producer. He formerly was vice president, director, and general manager of Continental-Diamond Fibre Corp.

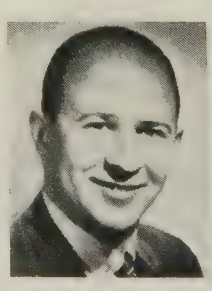
H. K. Collins

S. H. Levin

Sumner H. Levin, with the firm since 1958, has been appointed technical director for The Blane Corp., Canton, Mass., manufacturer of vinyl and polyethylene compounds and color concentrates.

Walter P. Mayfield has joined the advertising department of Shawinigan Resins Corp., Springfield, Mass., as a technical writer.

In the glass textile section of Johns-Manville Sales Corp., *Richard C. Schofield*, formerly in charge of fiber glass textile sales in the southeastern states, has been transferred to Los Angeles and will direct sales in Southern California and Arizona. Replacing him with headquarters at Atlanta is *Ralph G. Cox*, formerly southeastern regional staff manager for fiber glass in J-M's Industrial Insulations Div.

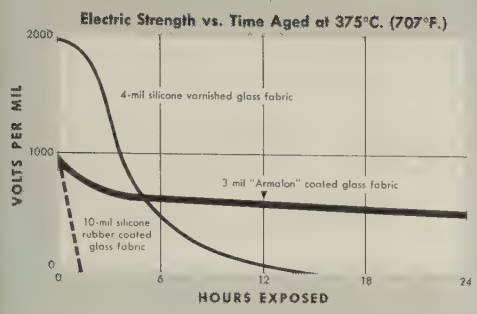


R. C. Schofield

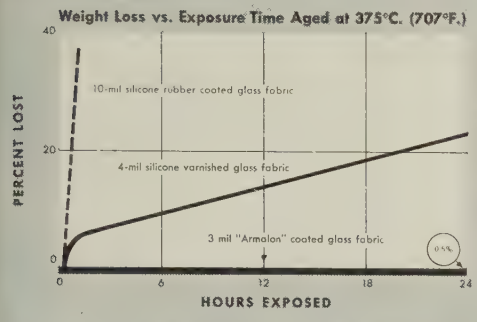
R. G. Cox

Roy N. Sundstrom has been named to the new position of senior project engineer for the Electrical Products Div. of Corning Glass Works, Corning, N.Y., producer of glass and ceramic materials and parts for electrical and electronic applications.

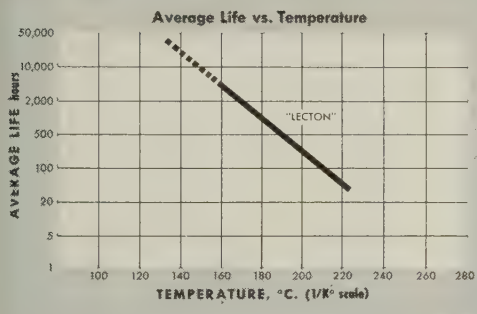
1. "ARMALON"



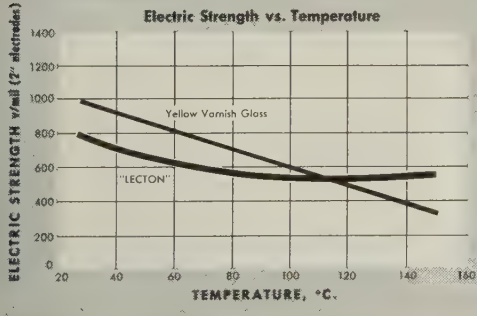
2. "ARMALON"



3. "LECTON"



4. "LECTON"



Thermal characteristics of 2 outstanding Du Pont coated fabric insulations

Armalon® for Class H service

For equipment that must operate at very high temperatures, "Armalon"* TFE-fluorocarbon resin coated glass fabrics have outstanding heat resistance. Insulation of "Armalon" can be used continuously at 482°F. and for short periods at even higher temperatures. Chart 1 compares high-temperature deterioration of electric strength for "Armalon", silicone varnished glass fabric and silicone rubber coated glass fabric at 707°F. Chart 2 compares weight loss for these insulations at 707°F. "Armalon" has much longer life at elevated temperatures and retains its flexibility and strength where ordinary materials become brittle. In addition, "Armalon" remains pliable at temperatures lower than -125°F. For full information about this outstanding Class H insulation, check the coupon below.

Lecton® for Class B service

"Lecton"* acrylic resin coated glass fabric is a superior insulation of moderate price that more than meets Class B requirements. It retains its properties in continuous operation at 270°F., and at 310°F. shows no appreciable loss in electric strength after 3,000 hours. Chart 3 shows the effect of temperature on the life of "Lecton", and Chart 4 compares the effect of temperature rise on dielectric strength for "Lecton" and yellow varnished glass fabric. "Lecton" has proved itself in Class B equipment because of its excellent thermal stability, and in hermetic refrigeration applications because of its superior resistance to fluorocarbon refrigerants and oils. For full information on this outstanding Class B insulation, check the coupon below.

FREE Illustrated booklets describe properties, test data and uses for Du Pont "Armalon" and "Lecton". Mail coupon or write Du Pont for your free copies . . . there's no obligation.

DU PONT
REG. U. S. PAT. OFF.

Better Things for Better Living . . . *through Chemistry*

*Du Pont's registered trademarks.

E. I. du Pont de Nemours & Co. (Inc.)
Fabrics Division IN-06, Wilmington 98, Del.

Please send free information on:

☐ **"ARMALON"** ☐ **"LECTON"**

Name _____

Position _____

Company _____

Address _____

City _____ Zone ____ State _____

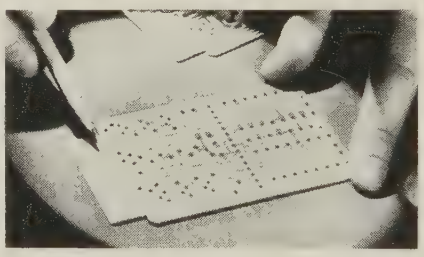
Print Ins. 42 on Reader Service Card

New Products

For further information on these products print the item number on the Reader Service Inquiry Card on the back cover. Fill out and mail the card—no postage is required. Insulation *will immediately forward your inquiry to the manufacturers concerned so that they can send you more information promptly.*

Flame-Retardant, Paper-Base Laminate Cuts Cost of Printed Circuits

A new paper-base phenolic laminate reportedly provides flame retardance with excellent cold punching characteristics at little more than half the cost of epoxy-paper laminates. Designated "Phenolite" grade XXXPC-476, the base stock is said to meet the electrical, physical, and mechanical requirements of NEMA standards and Underwriters Laboratories tests for flame resistance. It is also available in two copper-clad forms. *XXXPC-476-1* is a foil copper-



clad laminate with standard adhesive bonding made primarily for commercial radio and TV applications. *XXXPC-476-2* is a copper-clad laminate made primarily for electronic computer printed circuits and military applications requiring plating from alkali solutions. XXXPC-476 is claimed to be the first paper-base phenolic laminate to offer flame retardance with the cold punching characteristics of XXXP electrical punching grades. Insulating properties reported include perpendicular dielectric strength of 780 vpm (1/16", D-229, condition A); parallel dielectric strength of 60 kv (FL, ⅛", D-229, condition A) and 55 kv (FL, ⅛", condition D-48/50); insulation resistance of 20,000,000 megohms (1/16", D-257, condition A) and 250,000 megohms (condition C-96/35/90); dielectric constant of 4.1 (1/16", 1 mc, D-150, condition A) and 4.2 (condition D-24/23); dissipation factor of .033 (1/16", 1 mc, D-150, condition A and condition D-24/23). National Vulcanized Fibre Co., Maryland Ave. and Beach, Wilmington, Del.

Print No. Ins. 101 on Reader Service Card

More Effective Dielectric Gas

"Freon-C318" octafluorocyclobutane dielectric gas, now in semi-commercial production, reportedly boasts the highest dielectric strength available in a chemically inert dry gas at moderate pressures. It is said to make possible more reliable, lighter weight, high voltage electrical equipment, capable of handling voltages in the 100-kilovolt-per-inch range. It is claimed that in non-uniform electrical fields, the gas will sustain 30 to 50% higher voltages than currently used sulfur hexafluoride, while in uniform fields it will permit up to 30% higher voltages. The gas, which is both non-flammable and non-toxic, can be used with standard conductors, insulators, and all types of electrical construction materials at temperatures up to at least 250°C. Because of its chemical inertness and very low solvent power for magnet wire insulation and other solid insulation, liquid octafluorocyclobutane can be sprayed on transformer coils in a closed system where it will remove heat by evaporation. This heat then is given up to the atmosphere when the hot gas condenses on the shell of the transformer casing. E. I. du Pont de Nemours & Co., Freon Products Div., Wilmington, Del.

Print No. Ins. 102 on Reader Service Card

New High Density Polyethylene Compound for Wire and Cable

New high density polyethylene compound for wire and cable applications, "Bakelite" DGD-4100, reportedly combines the advantages of greater toughness, high abrasion resistance, reduced compressibility, and better heat deflection with greatly improved resistance to stress cracking

and thermal embrittlement. In standard IPCEA (Insulated Power Cable Engineers Association) tree wire abrasion tests, the new material withstood over 1,500,000 cycles—50% better than other high density polyethylenes tested. When tested for thermal embrittlement resistance, DGD-4100 exhibited no failures after 5000 hours of the Underwriters Laboratories heat shock test. In tests for resistance to environmental stress cracking (immersed in Igepal CO-630), time to initial failure at 50°C was greater than 500 hours. DGD-4100 has been approved as insulation for telephone cable, aerial spacer cable, and tree wire and is also being used in service drop cable, line wire, coaxial cable, and high-voltage power cable. Extrusion Technical Release No. 19 available. Union Carbide Plastics Co., 30 East 42nd St., New York 17.

Print No. Ins. 103 on Reader Service Card

New Mica Mat Composite with Increased Dielectric Strength

A new mica mat composite is said to have greater dielectric strength (1400 vpm) than any known mica insulation. The new laminate consists of silicone-bonded mica mat sandwiched between layers of silicone-varnished glass cloth. Designed for both class F and H applications, it is expected to be used as motor slot insulation, phase insulation, and layer insulation in transformers. Tests reportedly indicate that the mica mat composite has three times greater cut-through resistance (16,000 psi at 200°F) than any mica paper now available and 150% greater dielectric strength than either mica papers or built-up mica. In addition, greater conformity in wrapping transformer coils and insulating motor coil slots is claimed to result from the composite's improved flexibility and "snapback" characteristics. The increased mechanical and electrical protection offered by the new composite is expected to permit increased ratings of motors without changing frame sizes. Thicknesses are 8, 10, 12, 15, 20, and 25 mils. General Electric Co., Insulating Materials Dept., Schenectady 5, N. Y.

Print No. Ins. 104 on Reader Service Card

High Temperature Polyurethane Potting Compound

New Pro-Seal 777 high temperature polyurethane-based potting compound is a two-part material stated to have an operating range of —65°F to +350°F (—53.9°C to +177°C) and to possess extremely good electrical and physical properties. It is available in preweighed kits and premixed frozen cartridges. Coast Pro-Seal & Mfg. Co., 2235 Beverly Blvd., Los Angeles 57.

Print No. Ins. 105 on Reader Service Card

One Part Epoxy Insulating Adhesive for 200°C Uses

A new 100% epoxy adhesive, designated "Meta-Bond" 321, is said to be a thixotropic paste that can be easily applied without any running or sagging, even on vertical surfaces. It reportedly requires only short heat curing to form a strong bond stable at 200°C. High dielectric strength and low loss factor, excellent adhesion, and outstanding chemical resistance are claimed. The cured adhesive is stated to have a dielectric strength of 400 vpm (20-mil film), a dielectric constant of 3.8 (25°C, 10^3 cps), and a dissipation factor of 0.02 (25°C, 10^3 cycles). Shelf life is over one year if kept below room temperature. Metachem Resins Corp., 530 Wellington Ave., Cranston 10, R.I.

Print No. Ins. 106 on Reader Service Card

Rugged Duty Epoxy Laminate For Flush Printed Circuits

A new copper-clad industrial laminate is described as ideal for use where circuits must be forced into the laminate to produce a flush surface. Designated "Textolite" 11585, the new glass-reinforced epoxy laminate is said to be suited for high-reliability applications such as missiles, computers, and military electronic equipment that may be subjected to adverse operating conditions. Classified NEMA G-10, the material is designed to make printed circuits that take 30 minutes in boiling trichloroethylene, over 30 minutes in gold-cyanide solution, or 2 minutes in 500°F solder bath without blistering or bond failure. High insulation resistance, very low water absorption, high stability in humidity, and superior bonding strength are also claimed. General Electric Co., Laminated Products Dept., Coshocton, Ohio.

Print No. Ins. 107 on Reader Service Card

Long Ceramic Insulators for Use in Thermocouples at 3200°F

Ceramic insulators for thermocouples used in temperatures up to 3200°F (1760°C) are now available in lengths as long as 48″. Extruded from a 96% alumina composition, the tubing has a silica content of 1% or less. OD size range is from .040 to 1″ with single or double holes as small as .015″. Saxonburg Ceramics Inc., Saxonburg, Pa.

Print No. Ins. 108 on Reader Service Card

Fast-Drying Protective Coating For Electrical Applications

A new protective coating, "Humi-Seal" type 1B15, reportedly combines excellent electrical and moisture-proofing properties with outstanding outdoor durability. The one component system dries enough for handling in 10 minutes, while complete drying time at room temperature is 2 hrs. The coating is applied preferably by dip or brush and yields a build of at least two mils per application. Other properties cited include a dielectric strength of approximately 1700 vpm, dielectric constant of 2.5, and temperature range of —55°F to +270°F. The coating is claimed to be excellent for continuous application temperatures in excess of 130°C. Columbia Technical Corp., 61-02 Thirty-first Ave., Woodside 77, N.Y.

Print No. Ins. 109 on Reader Service Card

Colored Rod for Coil Forms and Bobbins

Rods of "Epocast" 341 are said to be readily machined into coil forms and bobbins for many electrical/electronic functions. Rods are available in 3′ to 4′ lengths and in a large number of standard colors. Samples available on written request. Furane Plastics Inc., Electrical Div., 4516 Brazil St., Los Angeles 31.

Print No. Ins. 110 on Reader Service Card

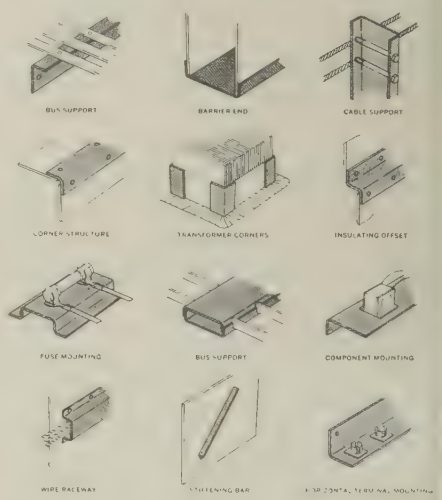
New Colored "Teflon" Pressure-Sensitive Tapes

New extreme temperature, pressure-sensitive "Teflon" tapes can be ordered in 10 colors designed in accordance with NEMA standards for color-coding in electrical applications. Colored "Temp-R-Tape" is .006″ thick and is said to have a temperature range of —100°F to 400°F (—73.3°C to 204°C), high dielectric strength, low power factor, and negligible moisture absorption. Available in 18 yd rolls, in widths from ¼″ to 2″, and by the lineal yard 12″ wide. The Connecticut Hard Rubber Co., 407 East St., New Haven 9, Conn.

Print No. Ins. 111 on Reader Service Card

New Structural Insulating Shapes

Five new sizes of insulating channel and angle stock bring to 10 the number of different structural insulating shapes which serve as low cost replacements for stand-off insulators, wood members, and insulated metallic members. The high strength, fiber

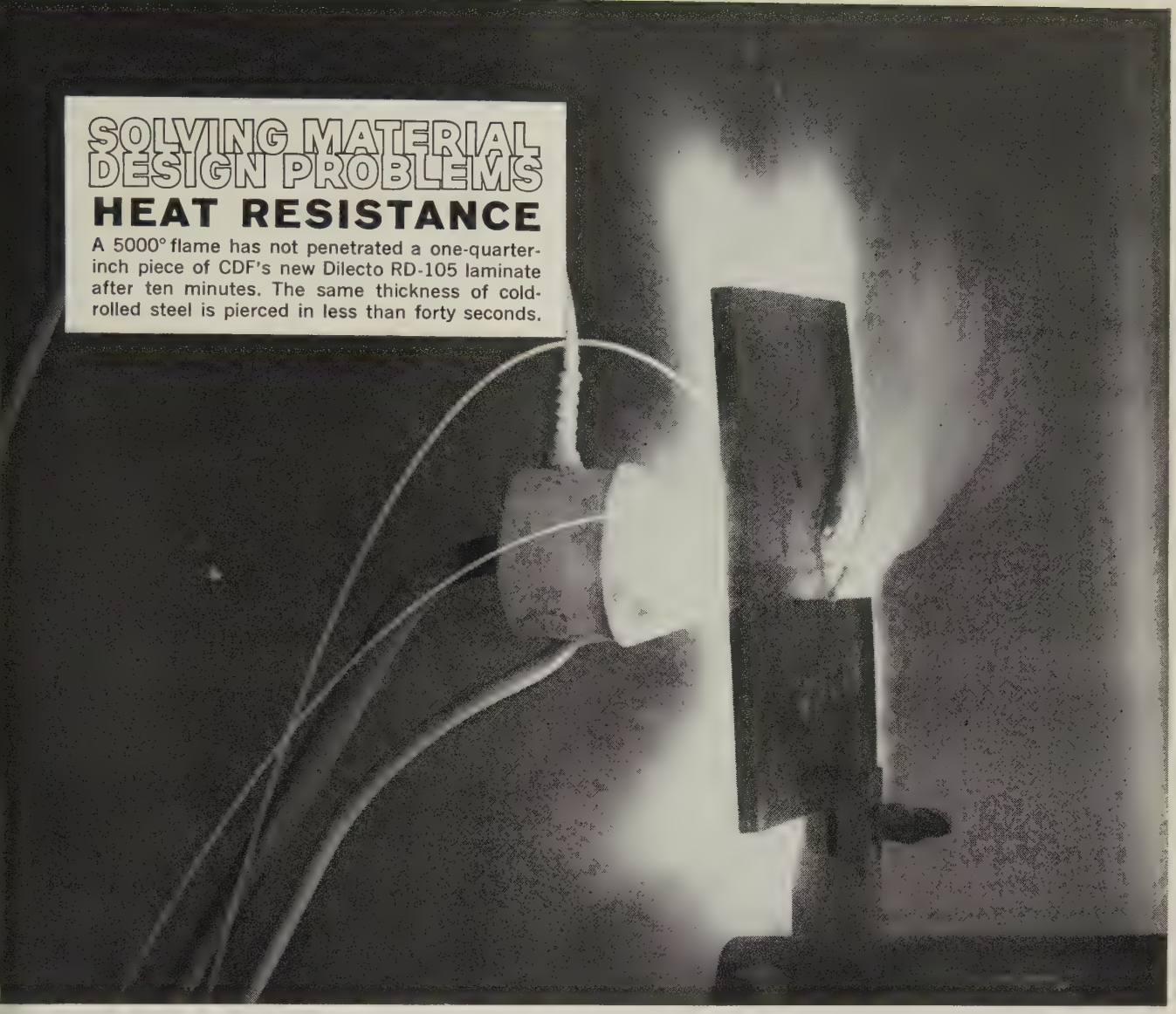


glass reinforced polyester stock is available in widths ranging from 2-3/16″ to 9-21/32″ and lengths from 28⅞″ to 75⅞″. The stock may be cut into angles or channels to meet particular job requirements—as bus supports, enclosures, cable supports, transformer corners, insulating offsets, fuse mountings, wire raceways, stiffening bars, etc. Engineered for use in equipment operating at class B temperatures (130°C), the stock reportedly meets NEMA GPO-1 specifications and has UL-recognized flame retardance. The Glastic Corp., 4321 Glenridge Rd., Cleveland 21, Ohio.

Print No. Ins. 112 on Reader Service Card

Linear Polyethylene Block

Linear polyethylene block is claimed



Molded from graphite fabric impregnated with a heat (ablation)-resistant phenolic resin, new CDF grades RD-105 and RD-115 are being evaluated in solid propellant rocket motors.

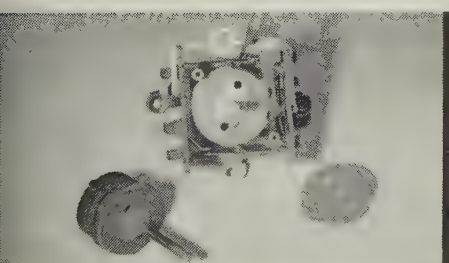
Dilecto laminates are only one family of products from industry's largest selection of non-metallic structural materials and electrical insulations. Vulcanized fibre, silicone rubber, mica, Teflon*, and thermosetting moldings are also supplied by CDF.

CDF can provide both quality and true economy in selecting plastic materials best suited to your needs. Refer to SWEETS PD file or write to us for General Folder 60.

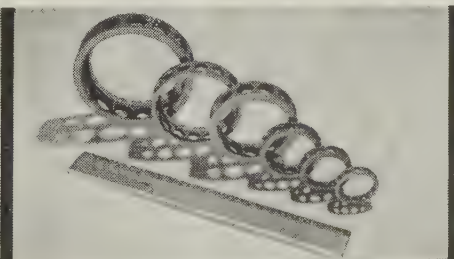
*DuPont trademark

CONTINENTAL-DIAMOND FIBRE

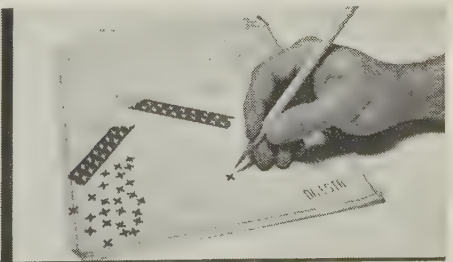
CDF® A SUBSIDIARY OF THE Bird COMPANY • NEWARK 17, DEL.



Moisture-resistant and low cost Dilecto cams for automatic washer and dryer controls.

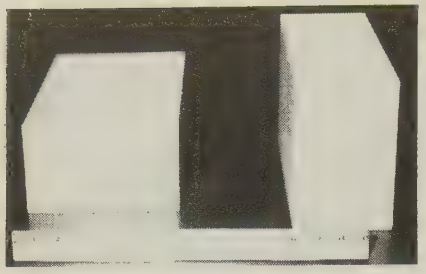


Dimensionally stable, light weight, oil-resistant Dilecto ball bearing retainer rings.



Easily fabricated paper-base, punching grade Dilecto precision switch insulators.

Print Ins. 45 on Reader Service Card

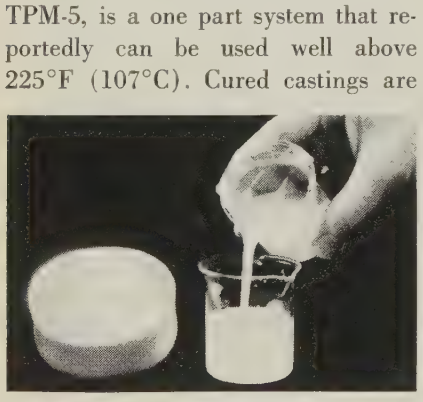


to be ideal for elevated temperature service and for secondary neutron shielding, to resist impact at temperatures above boiling water to far below freezing, and to possess superior dimensional stability and form retention. In block form it allows users to make prototypes of their own design for testing or for approval. Linear polyethylene is easily machined, ground, drilled, threaded, and welded with standard woodworking or machine tools and equipment. American Agile Corp., P. O. Box 168, Bedford. Ohio.

Print No. Ins. 113 on Reader Service Card

Polyethylene Casting Resins

A new polyethylene copolymer casting resin, designated "Stycast" TPM-5, is a one part system that reportedly can be used well above 225°F (107°C). Cured castings are



said to have physical and electrical properties similar to that of high density polyethylene. Emerson & Cuming Inc., 869 Washington St., Canton, Mass.

Print No. Ins. 114 on Reader Service Card

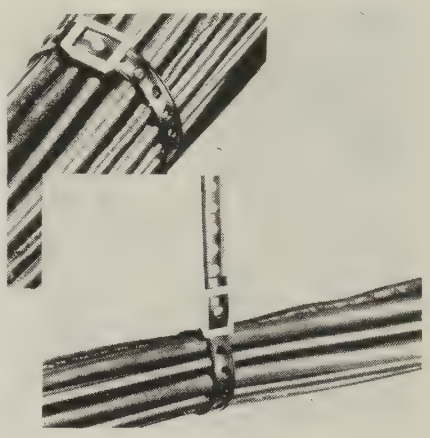
Glass-Silicone Laminate Up to 2 Inches Thick

Glass-silicone laminated plastic grade G-7 is now offered in sheets up to 2″ thick. The material, a glass fabric reinforced with silicone resin binder, reportedly has extremely good dielectric loss factor and insulation resistance properties under humid conditions, plus excellent heat and arc resistance. It is also said to meet NEMA requirements. Sheet size of random 24″ x 36″ is offered in thicknesses of ¼″ to 2″. Sheets of 36″ x 36″ size are offered in thicknesses of ¼″ and less. Synthane Corp., Oaks, Pa.

Print No. Ins. 115 on Reader Service Card

Nylon Ratchet Buckle Increases Usefulness of Perforated Strapping

A new nylon ratchet buckle designed for use with perforated nylon strapping is said to increase the versatility of the strapping. The ratchet buckle holds one end of the strapping

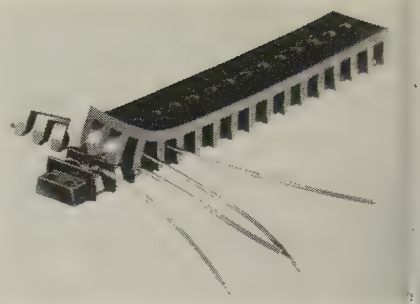


fast on its ratchet button. The other end reportedly adjusts to the desired tightness and cannot slip or loosen. Special clamps or hangers can be made to any size for securing the larger bundles of wires, cables, rods, tubing, and pipe or any combination. The one-piece molded natural-color nylon device is available in three sizes for use with ⅜″, ½″, or ⅝″ wide strapping. The nylon strapping is available in 25′ or 50′ rolls. The nylon material used is stated to be non-conducting, non-corrosive, lightweight, and strong. Weckesser Co., Dept. IN-2, 5701 Northwest Hwy., Chicago 46.

Print No. Ins. 116 on Reader Service Card

Rubber Terminal Block Covers

New rubber terminal block covers are available in a choice of neoprene, Buna-N, or silicate rubber in three basic forms. One type is a flexible casing, constructed with a wall between each terminal pole. The outer wall is slit to allow wires to be easily guided through the wall to the terminals. The pegged edge of the terminal block fits into the receiving holes of the cover, securing it in position. Another type is designed for



barrier strips. This cover fits firmly and quickly into place because the divider between each terminal is grooved to receive the terminal strip wall. It is pliable, easily installed or removed, and each connecting wire is separated by the dividing wall. The third type is a thimble-type, terminal cap for use where the larger unit is impractical. It is designed to fit over an individual terminal pole. The opening at either side is molded into a curved, protruding shield that adds further protection to the connecting wires. TA Mfg. Corp., 4607 Alger St., Los Angeles 39.

Print No. Ins. 117 on Reader Service Card

New Film-Insulated Magnet Wire In Ultra Small Size

A new 50-gauge AWG (.001) single enamel film magnet wire is designed for use in hearing aid transformers, subminiature relays, missiles, rockets, computers, and syncro-motors. A one pound spool has 335,000 con-

tinuous feet—about 65 miles—of wire. This size wire is also manufactured with coatings of polyurethane, "Formvar," "Isonel," "F. Bondall," "P. Bondall," and nylon. Viking Wire Co. Inc., Dept. I, Danbury, Conn.

Print No. Ins. 118 on Reader Service Card

UL Approved "Teflon" Hook-up Wire

A new line of UL approved appliance wire utilizing standard MIL-W-16878, Type E, Teflon insulation is rated at 80°C and 105°C with voltage ratings dependent upon applica-

"A girl has to think about Magnet Wire and specifications and things...."

"...I mean, really! Maybe you think that's too deep for an average housewife like me. But let me ask you, who's got the most to lose if magnet wire doesn't have the proper dielectric strength? Yours truly, that's who! Who suffers if the temperature and abrasion resistance isn't up there? Who but us, with all our appliances?

"I just wish we housewives could pick the magnet wire that goes into the motors and coils of every one of these things. I mean, really! Because I'd pick *Roebling Magnet Wire.* It's always higher than the NEMA Specifications. And if you think that's not important to a girl...!" For data, write Roebling's Electrical Wire Division, Trenton 2, New Jersey.

ROEBLING

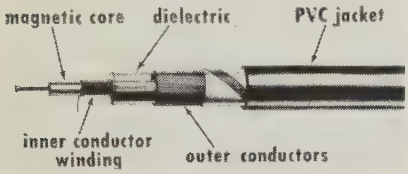
Branch Offices in Principal Cities
John A. Roebling's Sons Division, The Colorado Fuel and Iron Corporation

tion. The new hook-up wire is available in 20 AWG through 26 AWG, with 10-mil wall thicknesses. High temperature protection, soldering protection, and chemical resistance are claimed. Times Wire & Cable Co., a division of The International Silver Co., Wallingford, Conn.

Print No. Ins. 119 on Reader Service Card

Magnetic-Core Delay Cable

A new, patented delay cable reportedly is characterized by extremely wide bandwidth and excellent transmission characteristics. Known as type HH-1500A, the cable features an impedance of 1500 ohms and a delay of 0.08 microsecond per foot with delays on the order of several microseconds. Ratios of delay-to-rise time of 100:1 can be achieved. The delay cable has an OD of 0.4". It is very flexible and can be easily in-

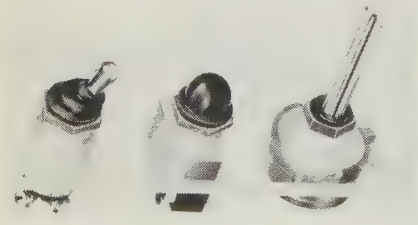


stalled in electronic equipment. It can be supplied in 100-ft bulk lengths or in calibrated sections with molded PVC end caps and tinned leads. Type HH-1500A is widely used in high quality applications where extreme fidelity of signal transmission is important. Columbia Technical Corp., 61-02 Thirty-First Ave., Woodside 77, N.Y.

Print No. Ins. 120 on Reader Service Card

Silicone Rubber Sealing Devices

A complete line of high pressure seals for toggle switches, push buttons, and shafts which pass through panels and housings are of one-piece construction made of silicone rubber bonded chemically and mechanically to a lock nut. They are used to protect against dirt, dust, fumes, and moisture. Operating temperature



range is —160° to 500°F. Catalog 358 available. Metal Process Co., 1801 First Ave., New York 28.

Print No. Ins. 121 on Reader Service Card

Zip-On Jacket Protects Wire and Cable from Wear and Abrasion

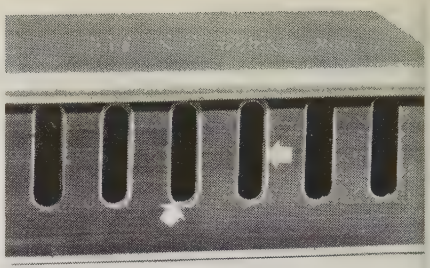
Wires and cables subject to wear and abrasion by trees or other objects can be protected by a Zippertubing jacket that can be zipped on in a few seconds by one man. The Zippertubing is available in a wide range of materials including fiber glass, vinyl, "Teflon," neoprene, and polyethylene. Vinylized Zippertubing of fiber glass or nylon cloth reportedly provides an excellent jacketing for outdoor applications because it is tough, pliable, mildew-proof, flame-resistant, and will

stand up under severe weather conditions. Supplied to users in tape form, Zippertubing is simply wrapped around the wires to be protected so that the beading on both edges of the tape lines up, then it is zipped shut. The Zippertubing Co., 752 S. San Pedro St., Los Angeles 14.

Print No. Ins. 122 on Reader Service Card

Plastic Duct with Rounded Slot Edges Protects Wire Insulation

Standard "Panduct" open-slot (type B) electrical wiring duct now has rounded edges on both inside and outside surfaces to provide protection to insulation on wires as they are pulled through wire slots during installation. They also protect insulation from subsequent chafing, cutting, and abrasion which could result from physical contact with sharp duct edges after the wires are installed. Made from a tough, non-flammable plastic that does not support fungus growth and will not irritate the hands of installers, the duct is also said to be easily cut and installed. A snap-cover

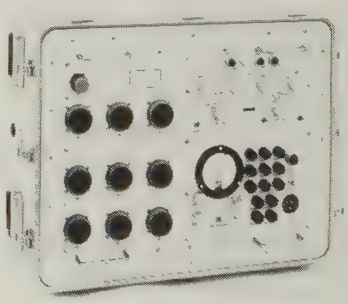


permits access for tracing or revision. Panduit Corp., Dept. IN-2, 14461 Waverly Ave., Midlothian, Ill.

Print No. Ins. 123 on Reader Service Card

Cable Harness Tester

Model 196 militarized cable harness analyzer reportedly allows simple and complex branch circuits to be high-potted and measured for leakage to all other circuits. Simultaneously with the leakage test, continuity (conductor resistance) is measured. In automatic operation the wires under test are checked at a maximum rate of five wires per second. When a fault occurs the tester stops and indicates the circuit and type of fault. The tester will check 150 simple circuits, 75 main circuits with any combination or number of branch circuits to a total of 75 branches, or any intermediate combination of main and branches up to a total of 150. Measurements are made on precision bridges which combine accuracy with fail-safe operation. Continuity testing can be made from 0.3 to 10.0 ohms at 0.5 to 3 amps.



High-pot testing can be made up to 1,000 volts d-c. For high-potting, a continuously variable control gives dwell times from 0.2 to 10 seconds. A built-in ohmmeter for manual checking measures leakage resistance from 0 to 1,000 megohms. California Technical Industries, Division of Textron Inc., 1421 Old County Rd., Belmont, Cal.

Print No. Ins. 124 on Reader Service Card

Spray Etcher for Big Circuit Boards

Model 300 spray etcher accepts

News about R&A SINCE 1913 **Adhesives**

FOR ALL METALS AND ALL PLASTICS

Spray, dip, roller coat these epoxies to bond machineable motor stacks

3 typical Bondmaster® series "E" adhesives for bonding stack laminations:

BONDMASTER E645: Available as 1-part or 2-part with mixed viscosity in the 600-1,200 cps range. Highest bond strength and heat-resistance coupled with excellent impact strength.

BONDMASTER E621: 1-part; approximately 200 cps viscosity. High bond strength, heat-resistance and flexibility. Can be cured at low temperatures.

BONDMASTER E631: Same as BONDMASTER E621 but in a slower-drying solvent.

Since all three feature excellent mechanical strength plus resistance to many solvents, to water, atmospheric conditions, and temperature changes, they are also widely used as insulating varnishes for impregnating coils and small electrical equipment.

•

TYPICAL PRODUCTION METHODS

Most companies develop their own techniques to bond stack laminates most efficiently. The three most commonly used are:

1) Coat, stamp, and stack;
2) Stamp, pre-coat, then stack;
3) Coil or stack, then vacuum impregnate.

•

NON-EPOXIES... an alternate method

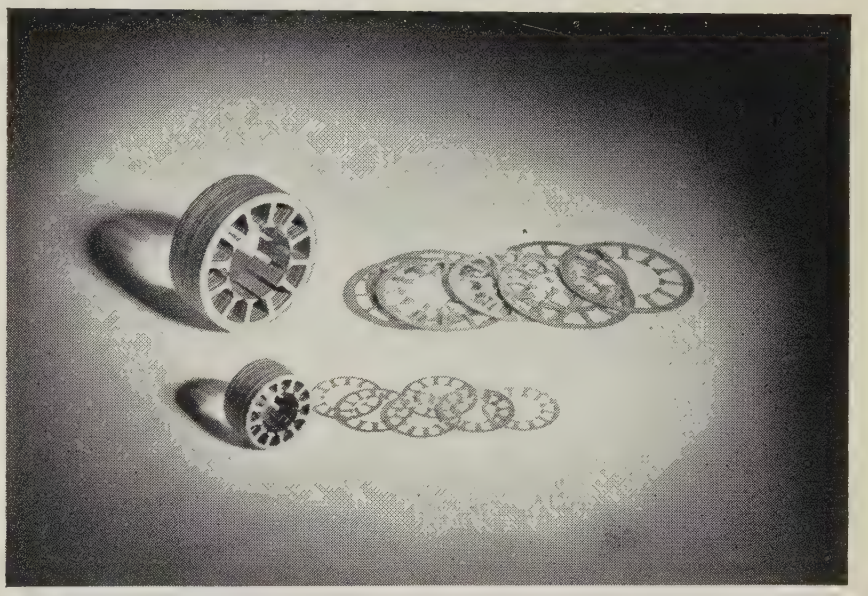
Huge electron accelerator magnet cores (a recent one involved 475 **tons** of oriented silicon steel laminations!) are being bonded with one of our **non-epoxy** solvent-dispersed rubber/phenolic adhesives. If you can heat-cure at pressures of 100 psi or more, write for information about BONDMASTER E379.

•

R&A SINCE 1913

RUBBER & ASBESTOS CORPORATION

226 BELLEVILLE AVENUE
BLOOMFIELD, NEW JERSEY



Now you can machine adhesive-bonded stack laminations of magnetic steel cores . . . machine them to tolerances as critical as you can control your equipment . . . *without fear of failures.* In addition, these laminations can now be produced without the internal stresses that have plagued the industry for so many years . . . can be made far more accurately, more uniformly, more swiftly than has ever been possible with riveted assemblies.

The "chemical fastening" of cores with BONDMASTER Series "E" adhesives is today's standard production technique in the manufacture of stators, rotors, pancake synchros, dry transformers, gyros, and servomechanisms as well as magnetic amplifiers, magnetrons, and cyclotrons.

With these solvent-dispersed thermosetting epoxy adhesive formulations, bonding is achieved by heat, alone. The only pressure you need is that required to keep the coated surfaces in complete and intimate contact during the cure cycle—a simple jig will do the job!

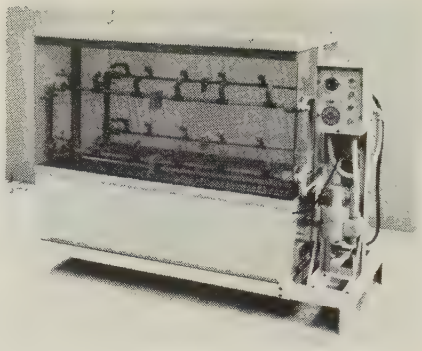
WIDE CHOICE OF APPLICATION METHODS

These extremely free-flowing, low viscosity (some go down to less than 200 cps) adhesives can be applied by brushing, roller coating, spraying, or dipping. Coated parts may be stored before curing for periods of up to six months, if desired. Stack laminating techniques can be adapted to *your* production set-up . . . see descriptions in column at far left.

WRITE FOR FURTHER DATA

Write for Technical Data Sheets detailing adhesive laydown, curing cycles, bonding methods, etc., of BONDMASTER Series "E" adhesives for the electrical industry.

Print Ins. 47 on Reader Service Card

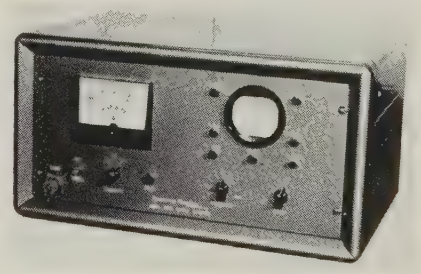


extra-large printed circuit boards and features consistent controllable etching of single-sided, single-sided back-to-back, or double-sided printed circuit boards. It is designed for low volume production or prototype etching of extra-large boards. Specifications listed are: Size—59″ x 25″ x 45″, weight—280 lbs, capacity—60 gal, board sizes—23″ x 44″, adjustable. Centre Circuits Inc., P. O. Box 165, 1101 N. Atherton St., State College, Pa.

Print No. Ins. 125 on Reader Service Card

System Detects and Measures Corona

A complete equipment system is designed for detecting and displaying on an oscilloscope any trace of corona, whether caused by voids within an insulating structure, insufficient clearances, or other defects in material or completed assemblies. The system

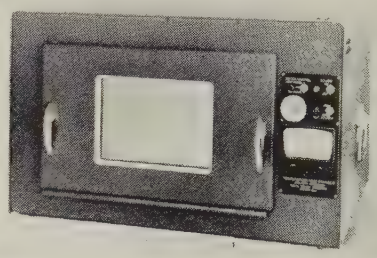


consists of a specially designed, corona-free "Hypot" to provide high test potential, a corona-free high voltage capacitor divider and associated filter in a network that extracts the corona signal from the high voltage output for display on the corona detector. The corona detector is a high gain, wide band amplifier which feeds a high sensitivity oscilloscope. Optionally, the system may be provided with a corona meter in place of, or in addition to, the oscilloscope. Bulletin available. Associated Research Inc., 3777 W. Belmont Ave., Chicago 18.

Print No. Ins. 126 on Reader Service Card

Portable Temperature Chamber

A precision temperature test chamber capable of accommodating rack-mounted electronic equipment reportedly makes prolonged temperature runs with stability to within ½°F over the range —100°F to +500°F (—73.3°C to +260°C). The new chamber is said to provide one of the most accurate temperature controls as well as the highest ratio of test volume to overall volume of any portable temperature chamber presently available to the electronics industry. Model 7000A has an internal test volume of

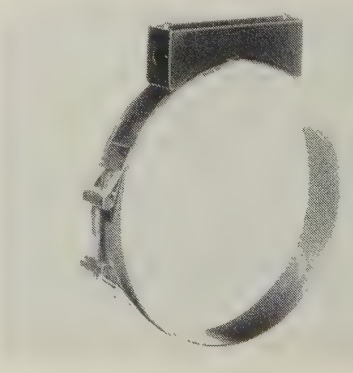


19½″ x 11″ x 15″. With an auxiliary timer-control unit (optional), Model 7000A can be preset for automatic hot-cold cycling at alternate temperature levels throughout the chamber's —100°F to +500°F range. The chamber has a "Pyrex" window for visual observation, and a large access port that accommodates all feed-through connections. Delta Design Inc., 7460 Girard Ave., La Jolla, Cal.

Print No. Ins. 127 on Reader Service Card

New Cylindrical Band Heaters For Plastic Molders and Extruders

A new line of cylindrical band heaters has been developed especially for plastic molding and extruding machines. An aluminized steel sheath and a wide, one-piece alloy clamping band is said to assure rapid heat transfer. A smooth internal contour provides a tight fit between the band and the cylinder for proper perform-

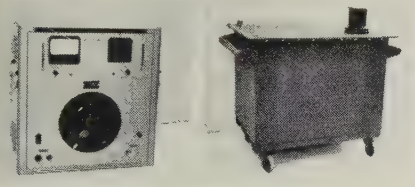


ance and long life. Standard heaters are available in 1½" width, inside diameters from 1⅝" to 18", and in a wide range of wattage and voltage ratings. Catalog sheet VB-159 available. Vulcan Electric Co., 88 Holten St., Danvers, Mass.

Print No. Ins. 128 on Reader Service Card

50 KV RMS Corona Test Set

Conforming to new MIL C-17-C specifications, IPCEA, and others with facilities for periodical checking of required 5$\mu\mu$ coulomb sensitivity, a new two-piece corona test set is composed of a high voltage section within an oil tank and a control cabinet for remote operation. It is designed for testing high-voltage bushings, ceramic terminals, wire and cable, electrical insulating materials, transformers, capacitors, and many other devices. The corona-free high

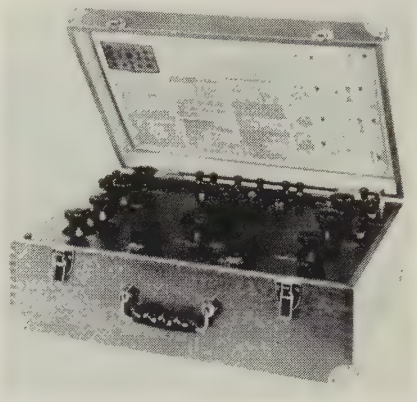


voltage section terminates in an oil-filled, corona-free bushing. The relatively small tank is on casters. The control cabinet is stated to provide continuously adjustable output control, zero start control, a spring-return "High Voltage On" push button, instantaneous-type Heinemann circuit breaker with trip-free reset, line switch, and pilot lamps. The detector panel contains a three-scale kv meter and a three-position scope sensitivity control, plus a group of concealed but readily accessible controls for other scope functions. This new design reportedly permits more accurate corona studies by indicating apparent corona charge and relative corona current. Also, the position and nature of the corona pulses on the scope help to determine if corona is due to poor geometry, a sharp termination, or an occluded void within good insulation. The Model #CT50-8 may be used as a straight dielectric breakdown tester in addition to its primary function as a corona test set. Peschel Electronics Inc., Towners, Paterson, N.J.

Print No. Ins. 129 on Reader Service Card

Bridge Measures Dielectric Loss, Capacitance, Dielectric Constant

New Hartmann & Braun Schering bridge, model MES 7, has been developed for measuring dielectric loss factor tanδ, the capacitance of test objects at high and low voltage, and for the determination of the dielectric constant of solid and liquid insulating materials. Highly accurate loss-free compressed gas capacitors of up to 1400 kv for comparison are supplied

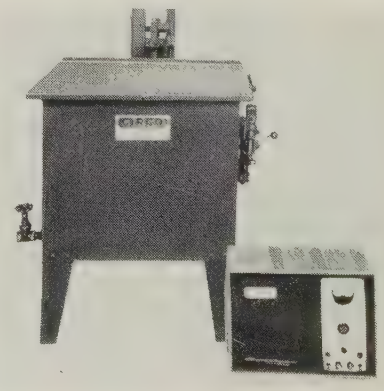


with the Schering bridge. Measuring range for capacitance is from 3 $\mu\mu$F to 10 μF and for tanδ from 2 x 10^{-5} to 1.111. Both ranges can be extended by using suitable accessories. A separate null indicator is used for balancing the bridge. The Schering bridge can be supplied either as a portable instrument or built in a specially designed test desk. Epic Inc., 150 Nassau St., New York 38.

Print No. Ins. 130 on Reader Service Card

New Cleaner Combines Ultrasonic Cleaning with Mechanical Agitation

A new "Circosonic" cleaner is stated to combine the advantages of high frequency ultrasonic cleaning and mechanical agitation in a single unit. The ultrasonic sound waves loosen the foreign matter from crevices, blind holes, and threads; the

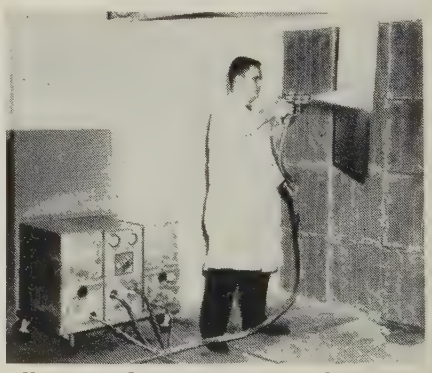


agitation action then floats it away. The cleaner, model 1PA-US, constantly cleans its own solution and maintains a preset temperature throughout the cleaning process. Overall dimensions are 26″ long by 29″ deep by 56″ high. Liquid capacity is 30 gallons; working capacity is 75 lbs per load. Circo Ultrasonic Corp., 51 Terminal Ave., Clark, N.J.

Print No. Ins. 131 on Reader Service Card

Gun for Spraying Multiple Component Insulating Materials

The new Binks Turbulator and Formulator system is said to solve reaction time and batch mixing problems associated with spraying of multiple component materials in insulating and other applications. The Turbulator is a specially designed gun for spraying plural component materials such as catalyst resins and plastics. Catalyst, activator, and resin are mixed inside the gun, then sprayed immediately. Tests reportedly show that materials with reaction times as low as four seconds can be sprayed on a continuous basis with the gun. The Formulator meters the materials to the Turbulator, report-



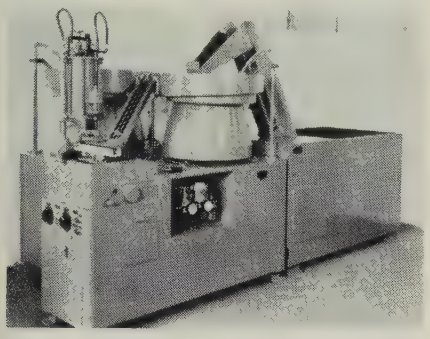
edly providing accurate make-up by weight and volume of the material being sprayed. Polyurethanes, gelcoats, epoxies, alkyds, and polyesters are a few of the materials that can be sprayed. Binks Manufacturing Co., 3114 Carroll Ave., Chicago 12.

Print No. Ins. 132 on Reader Service Card

High-Speed Machines for Filling Small Component Shells

A line of automatic high-speed filling machines has been developed for injecting viscous compounds into small components. The machines will fill circular apertures in such components as drawn or molded shells of diameters up to 2″ which lend

themselves to automatic hopper feeding. Various types of mastic of putty-like consistency are extruded in the form of a continuous band for injec-



tion into the components. All models are designed with variable volume-controlled filling cycles compatible with the material being dispensed. Parts to be filled are automatically fed from bulk hoppers at production rates claimed to range from 3,000 to 18,000 units per hour. Swanson-Erie Corp., 814 East 8th St., Erie, Pa.

Print No. Ins. 133 on Reader Service Card

Cutter for Hard-to-Reach Wire

The Little Snipper is a long nose wire cutter designed for reaching into complex, difficult-to-reach wiring arrangements. Made of aircraft steel, the Little Snipper is reported to cut the finest wire as well as 1/8" thick copper wire without the operator's hands ever touching the wire itself. The Little Snipper has a radial cut-

ting action. Depression of a simple lever or "trigger" on the pistol-type grip opens and closes the cutting jaws at the front end of the "barrel." This method of operation is said to prevent pinching of the operator's fingers. The Little Snipper reportedly can single out individual wires, cut flush in inside corners, or be used as a pincers to hold work for soldering or brazing without cutting the wire. It is available in six models ranging from 2" to 18" in length. Prices start

at $3.95. Literature available. E. V. Nielsen Inc., 575 Hope St., Stamford, Conn.

Print No. Ins. 134 on Reader Service Card

Laboratory Balance

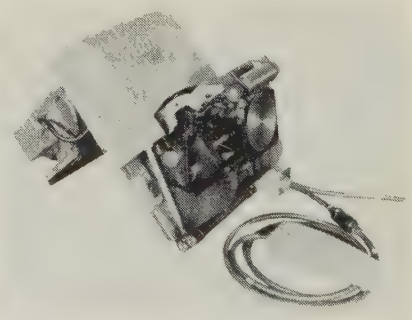
New "Toppan" balances, Sauter S-1000 series, have full floating indicating mechanism for correct weighing regardless of off-level conditions. Features claimed include: bright highly legible projection scale, no weights required, and for weighing

beyond optical range it is merely necessary to turn a control lever to remove a substitution weight with the added capacity indicated in a window adjacent to the scale. Literature available. August Sauter of N.Y. Inc., 866 Willis Ave., Albertson, L.I., N.Y.

Print No. Ins. 135 on Reader Service Card

Machine Prints Directly on Insulating Panels, Components

The Markem model 121A prints Underwriters Laboratories Manifest label legends directly on insulating panels, electrical components, and a wide variety of other items which have

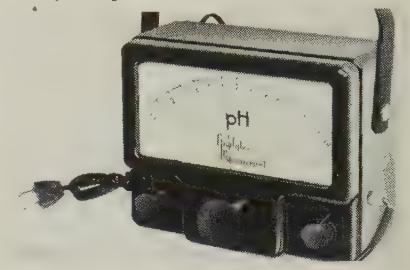


a flat surface for marking. The machine is said to provide clear imprints that resist weather and handling. Other legends can be used in conjunction with the UL legend. Production speeds up to 100/minute are claimed. Catalog available. Markem Machine Co., Keene 41, N.H.

Print No. Ins. 136 on Reader Service Card

Portable pH Meter

Model 700 Big Scale pH meter, making it simple to read pH values within .02 pH, is easily portable, and

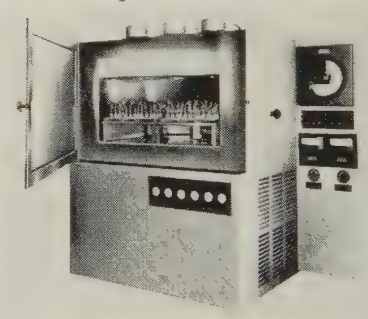


can be used wherever a standard 115 v a-c outlet is available. Price, complete with probe unit, buffer and KCl solutions is $145. Analytical Measurements Inc., 585 Main St., Chatham, N.J.

Print No. Ins. 137 on Reader Service Card

New Environmental Chamber with Accurate Temperature Control

Model WF-12-125+400 environmental chamber for research and development of materials and other applications requiring precise and accurate temperature control has an



adjustable temperature range from —125°F to +400°F. A 90-lb load of electronic components is lowered from +355°F to —85°F in 29 minutes, with a reverse cycle in the same time. Repetition of any desired cycle may be preset. Dimensions are 44″ x 24″ x 19″, and capacity is 12 cu ft. Instrumentation is programmed, visible, indicating, adjustable, and recording. Webber Manufacturing Co. Inc., P. O. Box 217, Indianapolis 6, Ind.

Print No. Ins. 138 on Reader Service Card

New Hardness Gauge for Rubber and Plastics

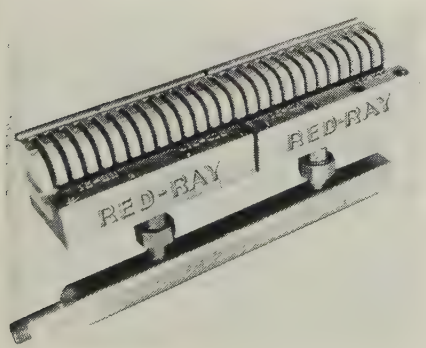
A new and improved hardness gauge, Rex Model 1500, indicates hardness of materials such as rubber and plastics in Durometer units that comply with ASTM specifications for rubber hardness. The vernier reads

directly to 5 points, permitting interpolation to about 2 points with average vision. The principal feature claimed for this gauge is the accuracy which is maintained during its lifetime, regardless of the amount of usage. Ruggedly constructed, it reportedly can be dropped on the floor without damage. Lifetime guarantee. Weight is 1½ oz. Price is $59.50. Rex Gauge Co., P. O. Box 46, Glenview, Ill.

Print No. Ins. 139 on Reader Service Card

Infrared Gas Burner Provides Low-Cost Heat for Baking & Curing

A new, high-radiation type "H" burner is designed expressly for applications in baking and drying ovens involving plastics, resins, varnishes, etc. It provides from 150 BTU to 3,000 BTU per linear inch, depending upon the gas-air mixture supplied. Energy cost with this new burner is said to be only a fraction of equivalent electrical energy cost. Combustion takes place completely within the fluted refractory, which attains operating temperatures to 2600°F when operated in the open. The burner is particularly suitable for oven, conveyor, rotary drum, and roll dryer applications since, due to its design,

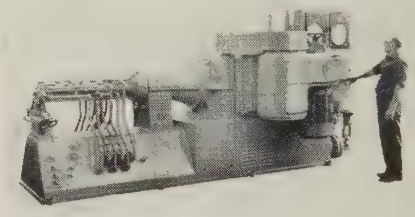


a combustion chamber is unnecessary and the flame is stable under high velocity circulation. Burners can be made in any desired lengths from 7″ to 100′ or more. Bulletins available. Red-Ray Mfg. Co. Inc., 318 Cliff Lane, Cliffside Park, N.J.

Print No. Ins. 140 on Reader Service Card

Heating and Cooling Unit For Plastics Processing

A new heating and cooling unit, developed especially for continuous mixers employed in compounding plastics or processing other materials where accurate temperature control is a must, reportedly controls temperatures to within ±2°, regardless of the mixer area involved. Its function is to heat or cool pressurized water which is circulated through the



jackets of the mixer and also an extruder, if one is employed. It will control the batch temperature in the mixer and extruder even if it is necessary to add heat in some zones and remove it in others. The pressurized water is handled at temperatures up to 360°F on the outside of the tubes, and steam at 375°F, inside the tubes. Chemical Machinery Division of Baker Perkins Inc., 1000 Hess, Saginaw, Mich.

Print No. Ins. 141 on Reader Service Card

Versatile Compacting Press For Electronic Components

The redesigned Model F-4 compacting press is a 4-ton single punch unit said to be ideal for making hermetic seals, tantalum capacitor anodes, barium titanate shapes, ferrite cores, glass beads, TV-gun mounts, and other electronic components. The F-4 press compresses from both top and bottom, which makes it especially suited for producing pieces of high density. It can make parts up to 1¼″ in diameter and 1¼″ depth of fill at rates of from 34 to 50 pieces per minute. F. J. Stokes Corp., 5500 Tabor Rd., Philadelphia 20.

Print No. Ins. 142 on Reader Service Card

New Literature

All catalogs, bulletins, and other literature or sample cards described are available free of charge. To obtain your free copies, just print the item number on the Reader Service Card on the back cover. Fill out and mail the card—no postage is required. Insulation *immediately forwards your requests to the companies concerned so that literature can be sent to you promptly.*

Bulletin on Modified-Polyester Heat-Resistant Insulating Varnish

A new bulletin presents both properties and performance data on "Isonel" 31 modified-polyester insulating varnish. Heat resistance and bonding strength properties are shown in graphs and tables. Form SV-116 also lists specifications and discusses outstanding features and temperature ratings. Applications in various types and sizes of motors, transformers, and generators are illustrated. 6 pages. Schenectady Varnish Co. Inc., Schenectady 1, N. Y.

Print No. Ins. 201 on Reader Service Card

Bulletin Gives Matching Government Grades for 26 Laminated Plastics

Government agencies' specifications corresponding to 26 laminated plastic sheet grades are listed in bulletin 3.0.1. The bulletin also lists the corresponding NEMA grade and gives the type of resin and filler used in each grade, including phenolic-paper, phenolic - cotton, phenolic - asbestos, phenolic-glass, phenolic-nylon, melamine-glass, silicone-glass, and epoxy-glass. Another table lists corresponding military designations, NEMA grade, and ASTM 709 type for company's grades of laminated plastic tubing and rods. A third table gives similar data for vulcanized fibre. 2 pages. Taylor Fibre Co., Norristown, Pa.

Print No. Ins. 202 on Reader Service Card

Silicone Engineering Guide

New "Engineering Guide to the Forms, Properties, and Applications for Dow Corning Silicones" contains the most current information on all forms of the company's silicone products. Discussions cover such electrical insulating materials as liquid dielectrics, soft film forming compounds, enamels and varnishes, insulating parts and components, laminating resins, molding compounds, potting materials, adhesives, additives, foaming resins and defoamers, release agents, and silicone rubber materials. 16 pages. Dow Corning Corp., Midland, Mich.

Print No. Ins. 203 on Reader Service Card

Printed Circuit Board Data File

New bulletin CE-3.00 reports on printed circuit board characteristics including bond and pull strength, resolderability, effect of solder, operating temperature, water absorption, flammability, electrical and mechanical properties, vibration, preferred stock thickness, and circuit material. Much data is also given on the glass-ceramic base material, manufacturing techniques are described, and advantages of the "Fotoceram" printed circuits are emphasized. 2 pages. Electronic Components Dept., Corning Glass Works, Bradford, Pa.

Print No. Ins. 204 on Reader Service Card

Publication Describes New Vinyl Insulation for Wire and Cable

Physical and electrical properties of "Opalon" 1040, a new vinyl compound for insulating type THW wire and cable, are detailed in a publication for the wire and cable industry. Results of oven aging and comparative long-term water immersion tests at 75°C as well as other performance data are presented. In addition, other subjects of interest to insulation engineers are covered. 8 pages. Monsanto Chemical Co., Dept. 713, Springfield 2, Mass.

Print No. Ins. 205 on Reader Service Card

Guide to Electrical Resins for Potting, Impregnating, Coating, Etc.

An easy-to-read guide to insulating resins and their uses, the new "Maraset Electrical Resins Selector," fea-

tures a recently developed series of epoxy formulations for potting, impregnating, dipping, and coating electrical and electronic parts and assemblies. Under separate classifications appear rigid and flexible resins, thixotropic pastes, varnishes, and the new polyurethane foam-in-place materials. The illustrated guide fits into office files or can be opened out for attaching to a wall or bulletin board.

For each resin system complete data is given on physical, mechanical, thermal, and electrical properties; type and proportion of hardener and the curing method employed; pot life; characteristics; and uses. The details are arranged in tabular columns for quick comparison of such features as temperature class and range, dielectric and impact strengths, viscosity, density, and shrinkage. 6 pages. Marblette Corp., 37-31 Thirtieth St., Long Island City 1, N. Y.
Print No. Ins. 206 on Reader Service Card

Phenolic-Glass Laminate Bulletin

Properties of grade G-3 laminated plastic, a laminate of woven glass fabric bonded with phenolic resin which is said to have excellent dimensional stability and heat resistance, and high tensile, flexural, and impact strengths, are tabulated in bulletin 3.5.1. Suggested applications listed include armature slot wedges, structural parts requiring good electrical properties, electrical equipment operated at temperatures up to 325°F, and armature slot liners. 3 pages. Taylor Fibre Co., Norristown, Pa.
Print No. Ins. 207 on Reader Service Card

Vinyl Tubing Data Sheet

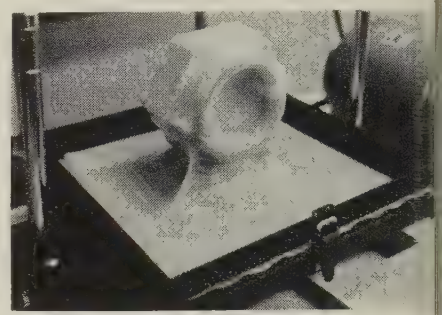
New data sheet lists the dimensional specifications for 27 sizes of extruded vinyl tubing for 105°C use. Weight, OD, wall thickness, minimum ID, nominal ID, and maximum ID are given for each size. 1 page. Wirecraft Inc., Rolling Prairie, Ind.
Print No. Ins. 208 on Reader Service Card

Two Bulletins on Polycarbonate Resin Production Methods

Two new bulletins discuss production methods for processing "Merlon" polycarbonate resins which are said to have high dimensional stability, good electrical properties, and high impact strength. Bulletin No. 44-M2 describes the procedure for producing Merlon plastic parts by injection molding; bulletin No. 47-M3 covers the subject of Merlon extrusion. The two new publications supplement an earlier bulletin, No. 41-M1, which provides a general description of properties and performance characteristics of the new self-extinguishing thermoplastic. Mobay Products Co., a subsidiary of Mobay Chemical Co., Penn-Lincoln Parkway West, Pittsburgh 5, Pa.
Print No. Ins. 209 on Reader Service Card

Booklet Describes Vacuum Forming Mold Methods for Casting Resins

Methods of forming molds for casting resins by vacuum-drawing heated thermoplastic sheets over electrical components are described in a booklet titled, "Conformal Casting of Motors, Transformers and Printed Circuits."



Photographs illustrate the process and a section is devoted to a discussion of materials and equipment required for developmental study. Among advantages listed for this method are: elimination of release agents; economical and effective use of resin; and ready adaptability to changing designs and production rates. 8 pages. Minnesota Mining and Manufacturing Co., Dept. WO-141, 900 Bush Avenue, St. Paul 6, Minn.
Print No. Ins. 210 on Reader Service Card

Flexible Tubing and Sleeving Catalog

Engineering data on complete "Alphlex" line of insulating tubing, sleeving, and zipper tubing for insulating leads, wires, and cables is provided by a new two-color catalog. Coated or impregnated braided sleeving as well as extruded plastic, "Teflon," and silicone rubber tubings are covered. Dielectric strength, temperature rating, flammability, and applicable military specifications are listed in tabular form for easy reference. 8 pages. Alpha Wire Corp., 200 Varick St., New York 14.
Print No. Ins. 211 on Reader Service Card

Extensive Price and Descriptive Catalog on Many Plastics

Revised catalog contains the latest information on company's line of plastics in sheet, rod, tube, and film forms. Material is organized to high-

light "most needed" data for convenient ordering. New products such as "Delrin," some copper-clad laminates, "Fluorglas," etc., are treated in detail. Other materials covered include "Plexiglas," vinyl, acetate, phenolic, nylon, "Teflon," polyethylene, "Kel-F," polystyrene, and "Rexolite." 68 pages. Commercial Plastics and Supply Corp., 630 Broadway, New York 12.

Print No. Ins. 212 on Reader Service Card

Bulletin Reviews Four Fluorinated Chemical Compounds

Four fluorinated chemical compounds having a number of electrical and other industrial applications and now available on a commercial scale are comprehensively reviewed in a newly revised technical bulletin. "Benzotrifluoride and Its Ortho-, Meta-, and Parachloro Isomers" is the title of Bulletin No. 12-A, which presents physical and chemical properties of each material and suggested applications. Twelve physical properties of these four compounds along with 13 typical chemical reactions are given. Applications cited include use as dielectric fluids, insulating media, and transformer fluids. 12 pages. Hooker Chemical Corp., P. O. Box 344, Niagara Falls, N. Y.

Print No. Ins. 213 on Reader Service Card

Article on Specifying Laminated Plastics and Vulcanized Fibre

Basic considerations for specifying laminated plastics and vulcanized fibre are discussed in an article reprint. A handy guide to the important do's and don'ts of ordering, the article describes the most common faults encountered in specifying and summarizes the basic properties of these materials. A chart spotlights outstanding properties of the various NEMA grade laminated plastics and vulcanized fibre. Photographs, tables, and charts illustrate the article. Also described are "extras" available in laminates at no additional cost, some basics on tolerances possible in fabricating, and a summary of the various composite laminates now possible. 8 pages. Taylor Fibre Co., Norristown, Pa.

Print No. Ins. 214 on Reader Service Card

Booklet on Molded Products for Electrical and Other Uses

Molded products for a wide rang of electrical and other industria applications are described in a ne booklet. It outlines a complete molde products service, which includes de sign of the part, design and fabrica tion of the mold, and molding of th part. Properties of 25 laminates avai able in molding grades are listed Photos show typical applications. pages. Formica Corp., 4614 Sprin Grove Ave., Cincinnati 32, Ohio.

Print No. Ins. 215 on Reader Service Card

Reference Chart of Tape Aids For Printed Circuit Draftsmen

A quick reference chart for printe circuit draftsmen includes all of th precut shapes and sizes of pressure sensitive drafting aids required t make paste-up printed circuit draw

ings that will conform to militar specifications, together with man new non-military configurations. It i claimed that this is the only char published that provides draftsme with actual size illustrations of th shapes and the available hole diam eters for each. The purposes of th several kinds of tape used for makin printed circuit drafting aids are full described. 6 pages. By-Buk Co., 131 West Pico Blvd., Los Angeles 19.

Print No. Ins. 216 on Reader Service Card

Data Sheet on High Temperature Wire With Ceramic-"Teflon" Insulation

New data sheet describes a resist ance alloy wire with new dual layer high temperature insulation of ce ramic and "Teflon." Performanc characteristics, specifications, and de sign and production consideration are discussed. Tables show diameter of wire available, insulation thickness and other data. 2 pages. The Kantha Corp., Amelia Place, Stamford, Conn

Print No. Ins. 217 on Reader Service Card

Laminated Plastics and Vulcanized Fibre Facilities Report

Facilities for research, develop

ment, production, and fabrication of laminated plastics and vulcanized fibre are illustrated and described in a new bulletin. Included are thumbnail descriptions of what laminated plastics and vulcanized fibre are and how they are made. Simple sequence drawings show how each material is made. 12 pages. Taylor Fibre Co., Norristown, Pa.

Print No. Ins. 218 on Reader Service Card

New Apparatus Bushing Catalog

A new catalog, bulletin No. 546, lists and describes apparatus bushings for transformer, circuit breaker, and special purpose applications in a complete choice of types, sizes, and ratings. Cover type bushings, sidewall, network, high current, corona free, high altitude, solder-seal, wall, floor, and roof types are among the other bushings included in this comprehensive catalog. 28 pages. Lapp Insulator Co. Inc., Le Roy, N. Y.

Print No. Ins. 219 on Reader Service Card

New Bulletin on Metalized Ceramic Housings for Encapsulating Resistors

Bulletin M-101 offers engineering data on a recently announced line of metalized ceramic housings for encapsulating resistors. It gives complete specifications, including the various grades of ceramic in which the housings are available, and lists the various advantages over other methods of encapsulating resistors. A table of 18 standard sized housings available is also included. 2 pages. Metalizing Industries Inc., 338 Hudson St., Hackensack, N. J.

Print No. Ins. 220 on Reader Service Card

Aluminum Conductors Engineering Data

A tool for electrical utilities—"Aluminum Electrical Conductors–General Engineering Data"—has been revised and expanded. The publication lists immediately available sag and tension charts for covered and bare aluminum conductors, and ACSR (Aluminum Conductor, Steel Reinforced). Sag-tension charts are used to determine engineering requirements in construction of power lines. The publication includes a complete glossary of aluminum conductors, alphabetized by code names; and is prepared in file size, punched for desk-top use in a loose-leaf binder. 100 pages. Aluminum Co. of America, 736 Alcoa Building, Pittsburgh 19, Pa.

Print No. Ins. 221 on Reader Service Card

Report on Improved PVC Extrusions Made with a Vacuum Hopper

New report, "Vacuum Hopper Extrusions," covers extensive tests of dry blend PVC extrusions made with a vacuum hopper attachment. Improved freedom from porosity defects, surface appearance, and electrical properties are described. The report tells how to produce extrusions directly from dry blends that have qualities equal or even superior to those formerly possible only with more expensive diced compounds. Escambia Chemical Corp., 261 Madison Ave., New York 16.

Print No. Ins. 222 on Reader Service Card

Bulletin on Plastic Molder for Research and Short Runs

New bulletin describes "Unex Jet" plastic injection molding machines said to be especially suitable for prototypes and experimental parts. Outstanding features are discussed, the unit is illustrated, and the steps involved in molding of small parts are illustrated and explained. Specifications and prices of the basic machine and accessories are given. 4 pages. Hinchman Manufacturing Co. Inc., 259 First Ave. East, Roselle, N. J.

Print No. Ins. 223 on Reader Service Card

Modular Infrared Oven Components

New bulletin 59-240 describes infrared equipment for use as heat sources in such processing operations as baking insulation on electrical windings, drying wet electrical equipment, drying glue on radar assemblies, preheating transformers prior to filling with pitch, baking clear coating on the inside of electrical conduit, and preheating and drying glass TV tubes. Full information is given on pre-engineered modular oven components incorporating T-3 quartz lamps, quartz tubes, or metal rods as sources for infrared heat. 8 pages. Fostoria Corp., Infrared Div., Dept. 44, Fostoria, Ohio.

Print No. Ins. 224 on Reader Service Card

Dates to Circle

Meeting and Convention Notices

June 1-2 . . . Institute of Recent Advances in Solid-State Devices, sponsored by Dept. of Electrical Engineering, Marquette University, Milwaukee.

June 1-3 . . . ISA, Symposium on Instrumental Methods of Analysis, Montreal, Canada.

June 1-3 . . . IRE, 6th Radar Symposium, Ann Arbor, Mich.

June 5-11 . . . Reliability Training Course, sponsored by IRE and the Electronic Div. of the American Society for Quality Control, Sheraton Towers Hotel, Chicago.

June 6-8 . . . Institute of Appliance Manufacturers, 28th Annual Convention and Exhibit, Netherland Hilton Hotel, Cincinnati, Ohio.

June 9-10 . . . The Wire Assn., Pacific Coast Regional Meeting, Statler Hilton Hotel, Los Angeles, Calif.

June 10-26 . . . British Exhibition of Industry, Technology, Science, and Culture, sponsored by the Federation of British Industries, Coliseum, New York City.

June 12-17 . . . Design Engineering Seminar, Pennsylvania State University, University Park, Pa.

June 13-15 . . . American Society of Heating, Refrigerating, and Air-Conditioning Engineers Inc., 67th Annual Meeting, Vancouver Hotel, Vancouver, B.C., Canada.

June 14-17 . . . National Association of Purchasing Agents, The Waldorf-Astoria, New York City.

June 18-26 . . . Europlastica Exhibition and Trade Fair, Floralies Palace, Ghent, Flanders. For information contact Europlastica Secretairate, Palais des Floralies, Ghent, Flanders; or Office Belge des Matieres Plastiques, Galerie du Centre, Bloc 3, Rue des Fripiers, Brussels.

June 19-24 . . . AIEE, Summer General Meeting, Chalfonte-Haddon Hall, Atlantic City, N.J.

June 20-22 . . . American Society of Refrigerating Engineers, Annual Meeting, Royal York Hotel, Toronto, Canada.

June 22-24 . . . Conf. on Electronic Stand ards and Measurements, NBS Boulde Labs, Boulder, Colo.

June 25-July 9 . . . IRE, Congress of Inter national Federation of Automatic Con trol, Moscow, USSR.

June 26-July 1 . . . ASTM, 63rd Annua Meeting & Exhibit, Chalfonte-Haddo Hall, Atlantic City, N.J.

June 27-29 . . . IRE, National Conventio on Military Electronics, Sheraton Par Hotel, Washington, D.C.

Aug. 8-12 . . . AIEE, Pacific General Meet ing, El Cortez Hotel, San Diego, Cal.

Aug. 18-19 . . . Electronic Packaging Sym posium, University of Colorado, Boulde Colo.

Aug. 23-26 . . . WESCON, Ambassado Hotel and Los Angeles Memorial Sport Arena, Los Angeles, Cal.

Sept. 7-8 . . . EIA, Second Conference o Value Engineering, Disneyland Hote Anaheim, Cal.

Sept. 7-9 . . . IRE, Joint Automatic Con trol Conference, MIT, Cambridge, Mass

Sept. 14-16 . . . AIEE-ASME, Engineering Management Conference, Morrison Ho tel, Chicago.

Sept. 19-22 . . . IRE, Space Electronics an Telemetry Convention and Symposium Shoreham Hotel, Washington, D.C.

Sept. 21-23 . . . AIEE-ASME, National Power Conference, Bellevue-Stratfor Hotel, Philadelphia, Pa.

Sept. 23-Oct. 1 . . . English Domestic Elec trical Apparatus Exhibition, Electrical Fairs Ltd., Alexandra Palace, London.

Sept. 26-28 . . . Standards Engineers So ciety, 9th National Convention, Pitts burgh Hilton Hotel, Pittsburgh, Pa.

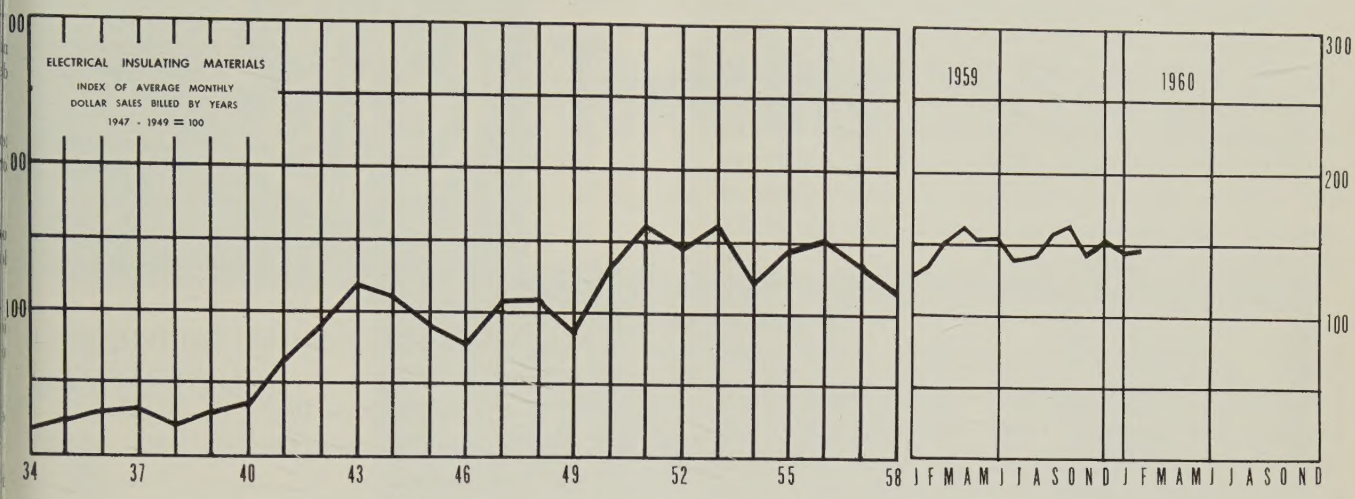
Sept. 26-30 . . . American Welding Society National Fall Meeting, Hotel Penn Sheraton, Pittsburgh, Pa.

Dec. 5-8 . . . Third National Conference on the Application of Electrical Insulation Conrad Hilton Hotel, Chicago.

Abbreviations Used in Notices

AIEE	—American Institute of Electrical Engineers
ASTM	—American Society for Testing Materials
ASME	—American Society of Mechanical Engineers
ASA	—American Standards Assn.
IRE	—Institute of Radio Engineers
EIA	—Electronic Industries Assn.
NEMA	—National Electrical Manufacturers Assn.
NISA	—National Industrial Service Assn.
SPE	—Society of Plastics Engineers
SPI	—Society of the Plastics Industry
WEMA	—Western Electronic Manufacturers Assn.

NEMA Electrical Insulation Index



	Feb. '60	Jan. '60	Feb. '59
Index series	149	146	138
Feb. '60 point change from other mos.		+3	+11
Feb. '60 % change from other months		+2	+8

Index is based on 1947-1949 average month, inclusive= 100

Published through the courtesy of the National Electrical Manufacturers Association

Materials Used in Electrical Insulation Index

Industrial Laminated Products

Manufactured Electrical Mica

Varnished Fabric and Paper

Vulcanized Fibre

Varnished Tubing and Saturated Sleeving (From May, 1952)

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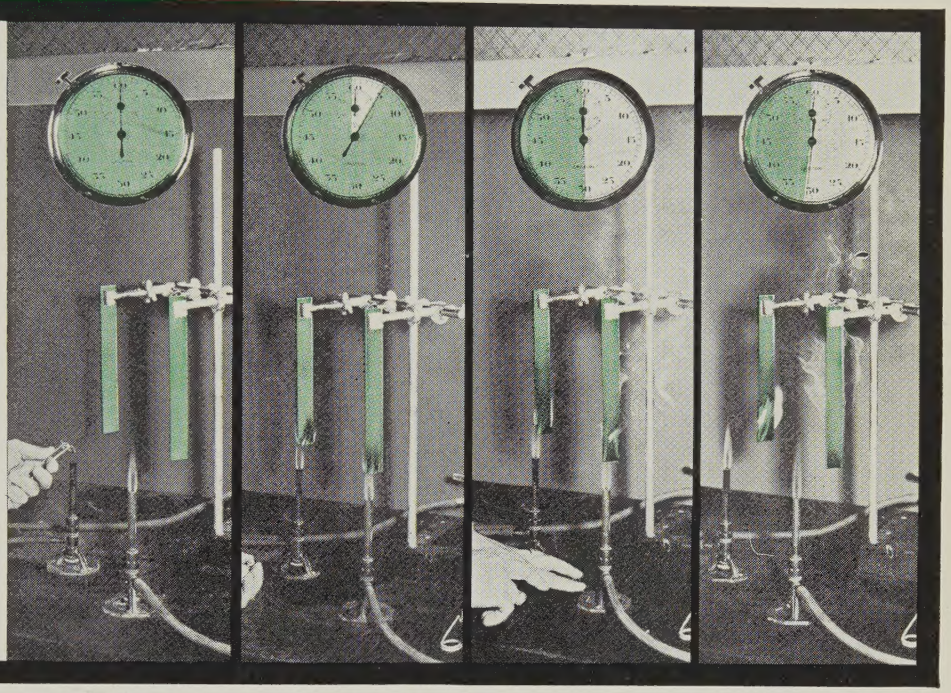
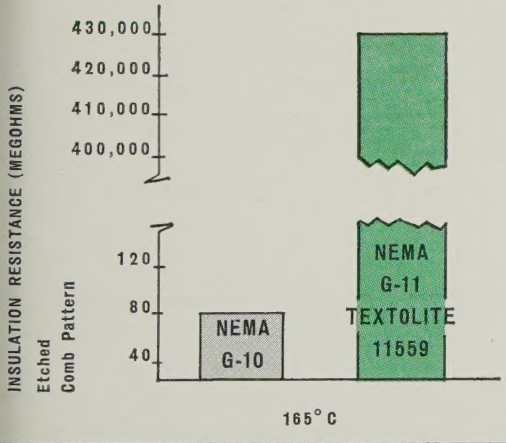
A BUILT-IN FIRE XTINGUISHER

Textolite® G-11 11559
self-extinguishing laminate



Actual flame test of a non self-extinguishing glass-epoxy laminate and Textolite G-11 (11559) glass-epoxy laminate. Less than two seconds after removal of burners, flame on 11559 dies, the other glass-epoxy laminate continues to burn.

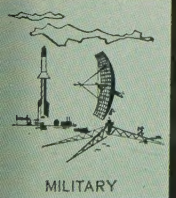
OUTSTANDING INSULATION RESISTANCE

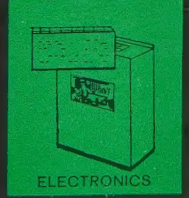


Reduce fire hazard. This problem confronts many designers of computer and military electronic systems, especially where banks of circuit boards are required. Their solution . . . specification of G-11, self-extinguishing G-E TEXTOLITE 11559 glass-epoxy for printed circuits and structural electrical insulating material. Laboratory tests more severe than Standard ASTM flame tests prove Textolite 11559 flames-out within two seconds —never presents a fire hazard.

Easily exceeding requirements for NEMA G-11 laminates and specifications MIL-P-18177 Type GEB, transparent 11559 is available unclad or clad with 1 or 2 oz. copper on one or both sides. It surpasses other G-10 and G-11 laminates in its electrical properties at higher temperature ranges. Specifically, it provides low power factor, low dielectric constant and high insulation resistance into the 150° C range. Since it is highly resistant to solvents and etching solutions, rejects are considerably reduced.

For more information on 11559, consult Sweet's Product Design File, Cat 2b/Gen., or write: Laminated Products Department, Section I-60, General Electric Company, Coshocton, Ohio.





Progress Is Our Most Important Product

GENERAL ELECTRIC

COSHOCTON, OHIO

Print Ins. 68 on Reader Service Card

NOW.. the first effective abrasion test for insulation sleevings

OPERATION OF THE ABRASOGRAFT

Alarm "A" rings, releasing golf balls "B" in Trap "C". Technician "D" is rudely awakened, kicks box "E" which frees horsefly "F". Fly bites horse "G" which stampedes on treadmill "H". Treadmill activates the Abrasograft and puts Ben-Har "1151" through its paces.

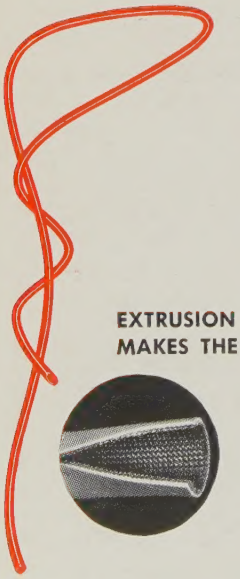
Aware of the void in standard testing procedures for abrasion resistance in insulating sleevings, Bentley-Harris commissioned Ubiquitious Associates, Limited, to correct the situation. Their chief designer, Dr. Kool(man), secreted in his study and stimulated by an exclusive diet of cheap whiskey, vitamin tablets and tranquilizers, produced the Abrasograft (illustrated above).

[Dr. Kool(man) is best remembered for his suggestions: to increase the number of commercials as the late, late show progresses; to double the sound volume of radio commercials; and to leave the fibrous parts in deviled crabs.]

The single phase, double reciprocating, triple purge, quadruped Abrasograft ran 1151 feet of the new Ben Har "1151" in size 36 (especially produced for the doctor as he is a stickler for perfection).

After 1151 hours, there was no blemish on the satin-smooth skin of the sleeving. Then, the Abrasograft exploded, plowing a trench 1151 feet long. When last seen, Dr. Kool(man) was at the far end furiously munching on the 1151 feet of undamaged Ben Har "1151" and muttering, "It's gotta give . . . it's gotta give."

Tough, expandable, resistable and completely able Ben Har "1151" **durasyl** Silicone Rubber—Fiberglass Sleeving comes in all the usual sizes, in white and living color. Don't take our word for its electrical insulation powers. Send for data sheet and samples and try your own patience.



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BENTLEY-HARRIS MANUFACTURING CO.
600 BARCLAY STREET **CONSHOHOCKEN 6, PA.**
Telephone: TAylor 8-7600 ***A SUBSIDIARY OF RAYCHEM***

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